*$ 7.95

Australia's best known Amateur gives you ALL the answers

DICK SMITH'S AUSTRALIAN AMATEUR RADIO HANDBOOK

- How to become an Amateur Radio Operator
- How to set up your own radio station and talk around the world
- A must for every Amateur's library

NEW EDITION FULLY REVISED

Foreword by the Hon. Ian Sinclair, Minister for Communications

DICK SMITH'S
AUSTRALIAN
AMATEUR
RADIO
HANDBOOK

EDITORS:
SAM VORON & DOROTHY DEGER

HORWITZ

This book is dedicated to the memory of
John Moyle, Editor of *Radio and Hobbies,* whose
magazine got me going in the first place.

Castle Books

Published 1982 by agreement with
Universal Copyright Company (1959) ©

Distributed by Horwitz Grahame Books Pty Ltd,
506 Miller Street, Cammeray, 2062 and
Gordon & Gotch Limited,
114 William Street, Melbourne, 3000, Australia

Copyright © 1979 by Horwitz Publications
Revised edition 1982

National Library of Australia
Card No. and ISBN 0 7255 1200 8

Designed by Robin Voigt

Printed in Australia by
New Century Press Pty Limited
5 Cumberland Street, Sydney, 2000

*Recommended price only

Contents

Introduction 4

Foreword 6

1. What Is Amateur Radio? 7
2. Types of Communication 19
3. Licensing Requirements 27
4. Man Made Aids for Radio Communication 37
5. What Makes A Radio Shack Tick 41
6. Getting Started On The Airwaves 53
7. How To Use The Different Amateur Bands 71
8. Homebrewing 99
9. Antennas 105
10. Accessories For The Shack 121
11. How To Solve Interference Problems 127
12. Operating Procedures For Exploring The Airwaves 133
13. Popular Amateur Activities 147
14. Amateur Radio Clubs 155
15. Short Wave Listening 161

International Morse Code 164

Local/Universal Time Chart 165

Australian DXCC Countries List 166

Sample Examination Papers (With Answers) 170

Club Directory 187

Data Section 197

Government Licensing Directory 207

Bibliography — Reference Books and Magazines 208

Introduction

Looking back, it's hard to remember a time when I was not fascinated by Amateur Radio. But, after checking with my parents, I can pinpoint the date as a certain December 25th some years ago when Father Christmas brought me my first soldering iron.

So, at the age of eight, I was able to experiment with one valve radios — walkie talkies were unheard of in those days. Then I progressed up the scale and managed to build a four valve transceiver that needed two people to carry it!

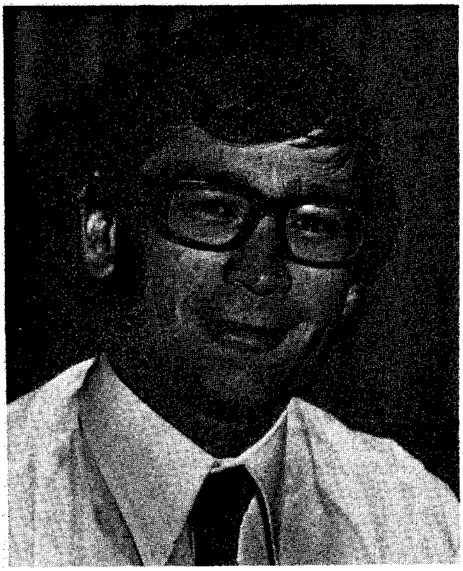
The amateur radio world has come a long way since then and I like to think that I have grown with it. I sat for my first licence before I left school and over the years I've operated from all sorts of unlikely places — anywhere from halfway up a mountain in the Himalayas to the cockpit of a Jumbo Jet flying low over the Antarctic . . .

I consider myself lucky to have been able to turn my hobby into an exciting career and profitable business. When you think about it, there are not too many hobbies that can lead to a full time job.

The aim of this book is to cover every facet of the Australian amateur radio scene, using fairly simple language that a layman can understand. I have deliberately avoided technical electronic jargon — the experienced ham knows this anyway and the beginner will have to learn gradually as he studies for the various amateur exams.

Although there are some excellent overseas publications dealing with amateur radio, much of the information is not applicable to the local Australian scene. I hope that this book, written specifically for the Australian reader, will fill an important gap in every amateur's library.

To the best of my knowledge the book contains explicit information on radio operating procedures and courtesies which have never been assembled together in print.



Dick Smith

VK2ZIP

P.S. If you hear me on air, how about sending me a QSL card to add to my collection?

Foreword

There will be many exciting and new frontiers for Australia in communications in the 80's and beyond.

Australia will be taking on the challenge of this new era to help conquer the great distances of our own vast continent as well as because of our relative remoteness to the rest of the world.

Amateur radio and its devotees have played a special role in meeting many communication needs, both within and beyond Australia.

As much as the wonderful work done in time of emergencies by hams, there should be particular emphasis made of the great national and international contacts and friendships built up on the amateur airwaves in the past 60 years they have been open.

It is this ever-expanding community of interests developing between amateurs, assisted by the new technologies, that will continue to expand understanding across all barriers.

A publication such as this makes a great contribution to opening the airwaves both to those already involved and to new generations of amateurs.

IAN SINCLAIR
Minister for Communications

Chapter

1

What is Amateur Radio?

What is Amateur Radio?

Amateur radio is a unique and exciting hobby that lets you sit by your own home radio station and speak to people all over the world, thousands and thousands of kilometres away.

The typical radio operator (commonly called a 'radio ham') spends a good deal of his spare time chatting with people halfway across the globe. Ham radio is a great way to make new friends, too — an Eskimo in Greenland who picks up a call from Australia is bound to answer.

WORLD WIDE HOBBY

Linking over a million people on the globe, amateur radio helps to promote international friendship and understanding. It's a hobby that bridges the generation gap and knows no territorial boundaries.

(There's another twist, too. Quite apart from the fun, I get a kick out of knowing that my leisurely half hour chat with Boris in Siberia won't feature on the next Telecom bill.)

As well as operating from home, many hams instal stations in their cars, boats or planes. Today's modern radio amateur could be of almost any age and come from any walk of life:

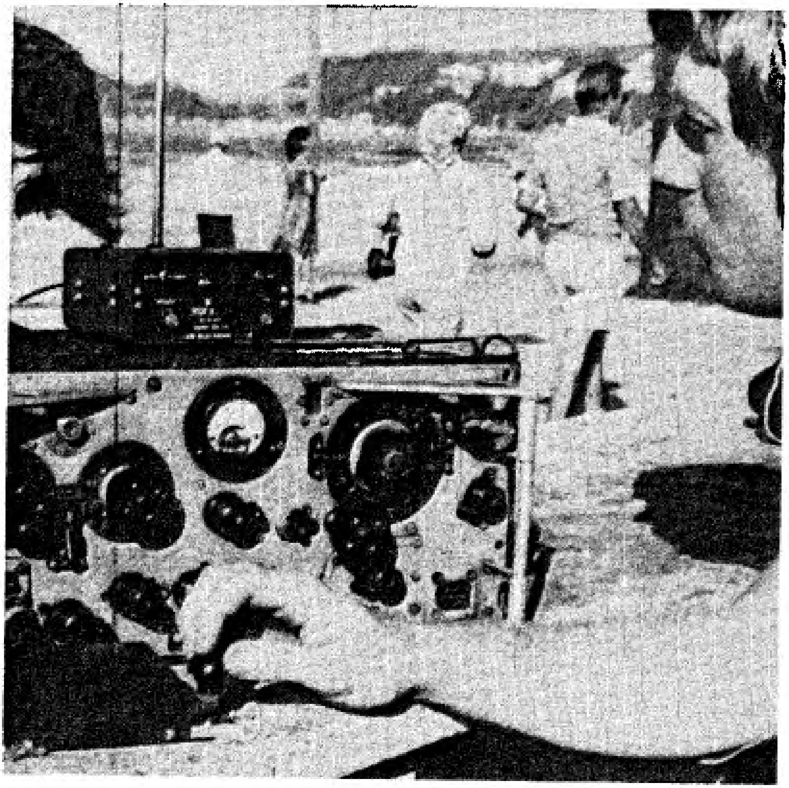
- it may be a doctor in AMSTERDAM taking a break from surgery,
- it could be a fourteen year old from JERUSALEM who just finished her evening homework,
- perhaps it's the King of JORDAN taking a rest from the business of politics,
- or an office worker in DJAKARTA or TOKYO having a lunch break.
- it may even be a naturalist studying wildlife on the GALAPAGOS ISLANDS.

The possibilities are endless.

Long distance communication — known as DXing in the ham world — is one of the most intriguing aspects of amateur radio. D stands for Distance, X for the Unknown.

(For instance, you'd have to admit my radio operator was DXing pretty successfully when he was lucky enough to talk with a guy stuck in a Los Angeles freeway traffic jam while we were on a plane heading for the South Pole!)

This YL must have won the lottery! Her shack has got the lot . . . including a mini computer and visual display unit.



Not everyone goes to the beach to swim . . .

Auction and surplus equipment sales mean bargain prices and are a way of life for the amateur enthusiast.

EMERGENCY SERVICES

There's a very serious side to amateur radio, too. In times of national emergency, such as the Darwin cyclone or the Nicaraguan earthquake, when all other forms of communication have been cut, the radio ham is there to establish a vital link with the outside world to bring help to stricken victims.

Twentieth century exploration also uses the help of amateur radio. In Dr David Lewis' solo yacht expedition to the Antarctic and back his only link with civilisation was amateur radio. Radio hams also play an important role in providing communication for exploratory teams in the remote jungles of Africa or South America.

THE COST?

By now you're probably thinking that if you don't have to pay for all these long distance calls then the cost of establishing a radio set up will be very expensive.

Here's the good news. Not so. You can build your own basic amateur transmitter very cheaply from a kit starting at about fifteen dollars or secondhand equipment is available starting from twenty to thirty dollars.

Now for the bad news. The more your interest in your new hobby grows, the more money you will want to plough back into upgrading your equipment. But money spent wisely is money well spent because it will increase your enjoyment from your home radio station, enabling you to try many more sophisticated methods of communication.

AMATEUR RADIO v. CB?

This is rather like comparing a Boeing 747 with a Tiger Moth. The Tiger is fun to fly and serves its purpose over short distances but the Boeing is obviously a much more sophisticated machine capable of far greater performance.

In other words, amateur radio operators can use a whole range of radio frequencies which give the best local and worldwide communication. CBers, however, are restricted to a small fixed number of channels and can only communicate over comparatively short distances.

Amateurs are allowed to use over thirty times more power than CBers. They may also construct and operate their own equipment, modify commercial equipment and conduct experiments. CBers must use "Type Approved" commercial equipment and are not permitted to adjust, modify or add to their sets in any way.

Many people find that CB is as far as they want to go with radio, but others, having tasted the fun, want to broaden their horizons and become radio hams.

A very basic difference between CB and amateur radio is that in CB it is the *set* that is licensed, but in amateur radio it is the *operator* who has to be licensed.

(Don't panic – you don't have to be an electronic genius or study day and night for a year. The exams are fairly simple for anyone of average intelligence.)

The exam exists to ensure that you can operate your equipment in safety without interference to others on the air. (See Chapter Three for full details.)

TYPES OF COMMUNICATION

So far we've been talking about amateur radio 'communication' in general terms. Now it's time to be more specific. There are really four different ways of communicating or, more correctly, transmitting and receiving.

1. By voice. This is known as *Wireless, Telephony,* or just plain *Voice Transmission.*
2. By fingers, using Morse Code. This is known as *Wireless Telegraphy* or *Continuous Wave* (CW).
3. By sight. Amateur radio operators can send black and white or coloured photos round the world using a simple adaptor connected to an ordinary transmitter. This is called *Slow Scan Television* (SSTV). Live movies can also be transmitted by a process known as *Amateur Television* (ATV).
4. By printing. Teleprinter machines can be connected to radio sets. Messages are sent and received by a form of communication known as *Radio Teletype* (RTTY).

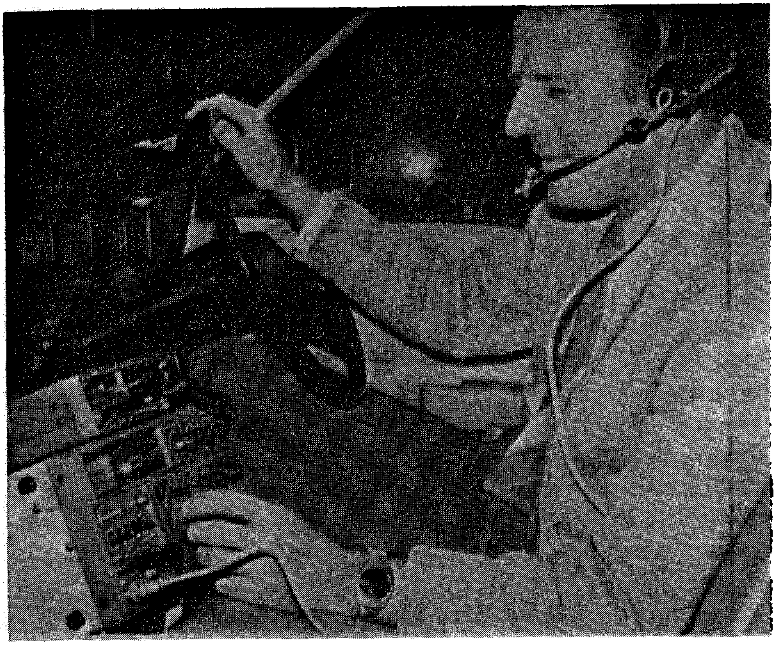
(Intriguing, eh? That should be enough to whet your appetite for the moment, but in the next chapter I'll go into more detail about these different types, or 'modes', of communication.)

THE BEGINNING OF AMATEUR RADIO

It all started back in the days of Marconi who showed that messages could be transmitted without the use of wires. As the word spread, the imagination of private citizens around the world went wild as they tried to learn how to build this strange device called the wireless.

They learned the Morse Code, the only known way of communicating at that time, and soon hundreds of private citizens were on the airwaves exploring this new scientific marvel. They became the first radio amateurs — private citizens who had taught themselves how to get on the air using homemade spark transmitters and crystal set receivers.

Soon they began trying different types of antennas and circuits to improve the quality and range of their simple transmitters and receivers which may have consisted of just four or five components.



You can communicate all over the world operating mobile from your car.

There were no regulations, licences, laws or frequency allocations — government, commercial and hundreds of amateur radio operators shared the known frequencies on which the equipment was capable of operating.

By experimentation they were able to expand their range from just a local coverage to many hundreds of kilometres. Occasionally it was possible to make two way contacts with people over sixteen hundred kilometres away.

In 1910 Australia had the distinction of being the first country in the world to form an amateur radio society — known then and today as the Wireless Institute of Australia or the WIA.

Shortly afterwards came World War 1. Although governments, particularly the American and English, enlisted the services of amateurs for war communication purposes, radio was strictly controlled by officialdom.

At the end of the war, the American government was very reluctant to give up its total control over communication. Legislation was being hurriedly prepared to keep amateurs off the airwaves forever.

Then the battle began. Amateurs banded together to fight for the legalization of amateur radio. *(In many ways, I suppose, the battle by amateur radio enthusiasts to make their hobby legal has many parallels with the comparatively recent fight to legalise CB in Australia. The end result was the same: the good guys won!)*

The lifting of the ban saw a massive rush by amateurs to get onto the airwaves. Using spark transmitters, dozens of new stations came crashing on the airwaves each evening. Manufacturers were hard pressed to meet the demand for radio apparatus. The enthusiasm for amateur radio was verified by the resulting interference and bedlam on the airwaves. (CBers please note!)

In 1924 the first of a series of International Conferences partitioned off certain parts of the radio spectrum for amateur, government and commercial use. The radio world was at last being put into a structured form of order.

As the Australian amateurs continued to experiment during the nineteen twenties, reliable contacts were first made across the Pacific to America. Soon after came the ability to talk around the world in daylight hours.

How had these early amateurs consistently managed to increase the distance of their transmissions? The answer revolves around such things as 'wavelength' and 'frequency'. Many people reading this book will be instantly familiar with these terms but, for the sake of the uninitiated, let's define them.

'Frequency' is the number of waves generated in a specified time, usually one second. The common unit of measurement is known as Kilohertz (KHz) or Megahertz (MHz) meaning, respectively a thousand or a million wave cycles per second. The basic unit of frequency is the Hertz (Hz) which equals one cycle per second.

'Wavelength' is the length of one cycle measured in metres.

Frequency and wavelength are directly related to each other. (See chart on page 15.)

AMATEUR BANDS AND THE RADIO SPECTRUM

Amateur radio, just like all the other users of radio, is given certain frequency bands on which it is allowed to operate. A band is really a way of identifying a whole range of frequencies. For example, the eleven metre CB band contains all of the eighteen CB channels or eighteen CB frequencies. On an ordinary radio receiver the "medium wave" or "broadcast band" contains all the frequencies on which your local commercial stations are allowed to broadcast.

In this same way amateur bands contain all the frequencies on which amateur radio hobbyists are permitted to operate.

A radio spectrum can be drawn, which shows the name given to the different bands of radio frequencies and wavelengths. (See Fig. 1.)

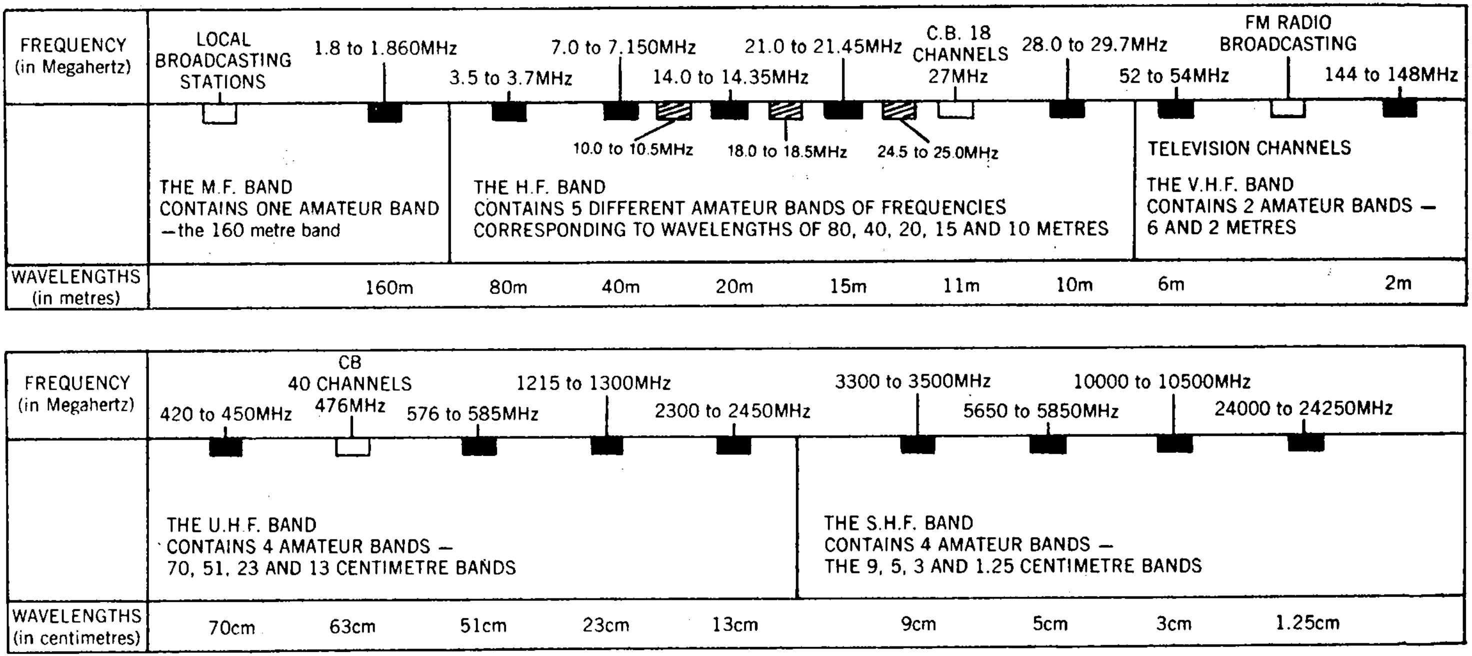
Amateurs are allowed to use some sixteen different frequency bands scattered across the radio spectrum. Each band is unique in that it can take a radio signal into parts of Australia or parts of the world which other

THE RADIO FREQUENCY SPECTRUM

10KHz-30KHz	30KHz-300KHz	300KHz-3MHz	3MHz-30MHz	30MHz-300MHz	300MHz-3000MHz	≥ 3000MHz	FREQUENCY IN MEGAHERTZ (MHz)
VERY LOW FREQUENCY BANDS (VLF)	LOW FREQUENCY BANDS (LF) LONG WAVE (LW)	MEDIUM FREQUENCY BANDS (MF) MEDIUM WAVE (MW)	HIGH FREQUENCY BANDS (HF) SHORT WAVE (SW)	VERY HIGH FREQUENCY BANDS (VHF)	ULTRA HIGH FREQUENCY BANDS (UHF)	SUPER HIGH FREQUENCY BANDS (SHF)	
30000m-10000m	10000m-1000m	1000m-100m	100m-10m	10m-1m	1m-10cm	≤ 10cm	WAVELENGTH IN METRES (m) OR CENTIMETRES (cm)

FIG. 1:

Amateur radio, CB radio, the Police, the Broadcasting and TV Stations all operate on different bands within the radio spectrum. This diagram shows the different bands from the Very Low Frequency bands (VLF) up to the Super High Frequency bands (SHF) as well as the frequency and corresponding wave lengths of each band, i.e. the High Frequency bands occupy the radio frequencies from 3 to 30 MHz which is the same as the radio wavelengths from 100 to 10 metres.



AMATEUR FREQUENCY ALLOCATIONS

FIG. 2:

The sixteen bands available for use by radio amateurs are spread across the radio spectrum from the Medium Frequency up to the Super High Frequency bands. The location of each of the amateur bands in relation to the frequencies used for broadcasting, CB and Television are given above.

▨: Future amateur bands.

amateur bands may not be able to do at that particular time. It is this ability to hop from one frequency to another that makes communications so dependable and the exploration of the different amateur bands so fascinating.

Fig. 2 shows the location of these sixteen amateur bands within the radio spectrum.

HOW HIGH CAN YOU GO?

It is interesting to note that during the very early days of amateur radio it had been found that the higher the frequency used, the further the radio message could travel. Officialdom had originally hoped that by restricting the amateurs to less than 1.5 MHz the amateurs would 'never be able to get out of their backyards'. Officialdom, of course, was proved very wrong.

Today, frequencies as high as 24000 MHz are available for exploration by the modern amateur.

(The experts now say that anything higher in frequency is useless for

Not all shacks are spic and span . . . 'beauty is in the eye of the operator'.

transmitting further than the back fence . . . sounds familiar, doesn't it? I wonder who's going to show 'em?)

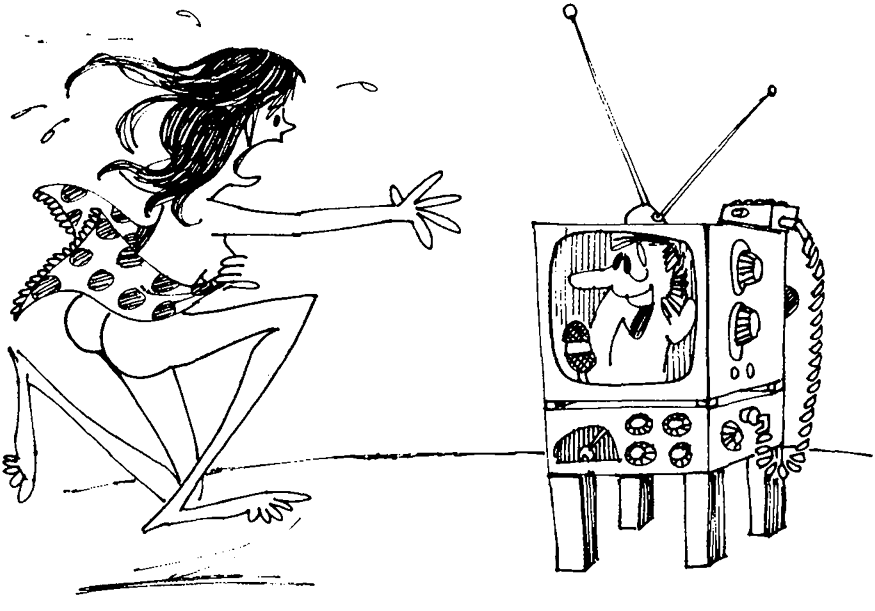
One thing is for sure, it won't be you unless you turn the page and start finding out about the different types of radio communication and how to get your licence . . .

. . . Nor will you be into 'homebrewing', 'moon bouncing', 'satellite transmitting', 'meteor scatter' and all the other fascinating aspects of amateur radio.

Chapter

2

Types of Communication



Types of Communication

The various types or 'modes' of communication were mentioned briefly in Chapter One. Now it's time to get down to the real nitty gritty.

VOICE TRANSMISSION

Single Sideband or SSB is the most popular form of long distance voice transmission. There are two types of SSB voice transmissions — UPPER SIDEBAND (USB) AND LOWER SIDEBAND (LSB). Both forms of transmitting voice are identical except that one is found slightly higher in frequency than the other, hence the term upper or lower sideband.

To tune in an SSB station, normally you would have to flick a switch on your radio receiver to either USB or LSB. To save time in trying to tune in SSB, amateurs all over the world have agreed to use lower sideband on the amateur frequencies below 9 MHz and upper sideband on the frequencies above about 9 MHz. This means that if you are tuning your receiver on a certain band of frequencies, you can leave your SSB switch on either LSB or USB without having to change this control all the time.

Amplitude Modulation or AM is another form of voice transmission. It's the same type of signal you hear on your ordinary broadcast radio. It's very easy to tune into. Although SSB is better for long distance, some people like the challenge of working distant stations (DX) the hard way on AM. An advantage of AM is that it is less expensive than SSB.

Frequency Modulation or FM is the third form of popular voice transmission. It is the same type of transmission as you hear on normal radio FM broadcasts and it is popular for local, good quality communications. The range of FM is similar to AM on the same frequency.

(See page 56 for correct voice operating procedure.)

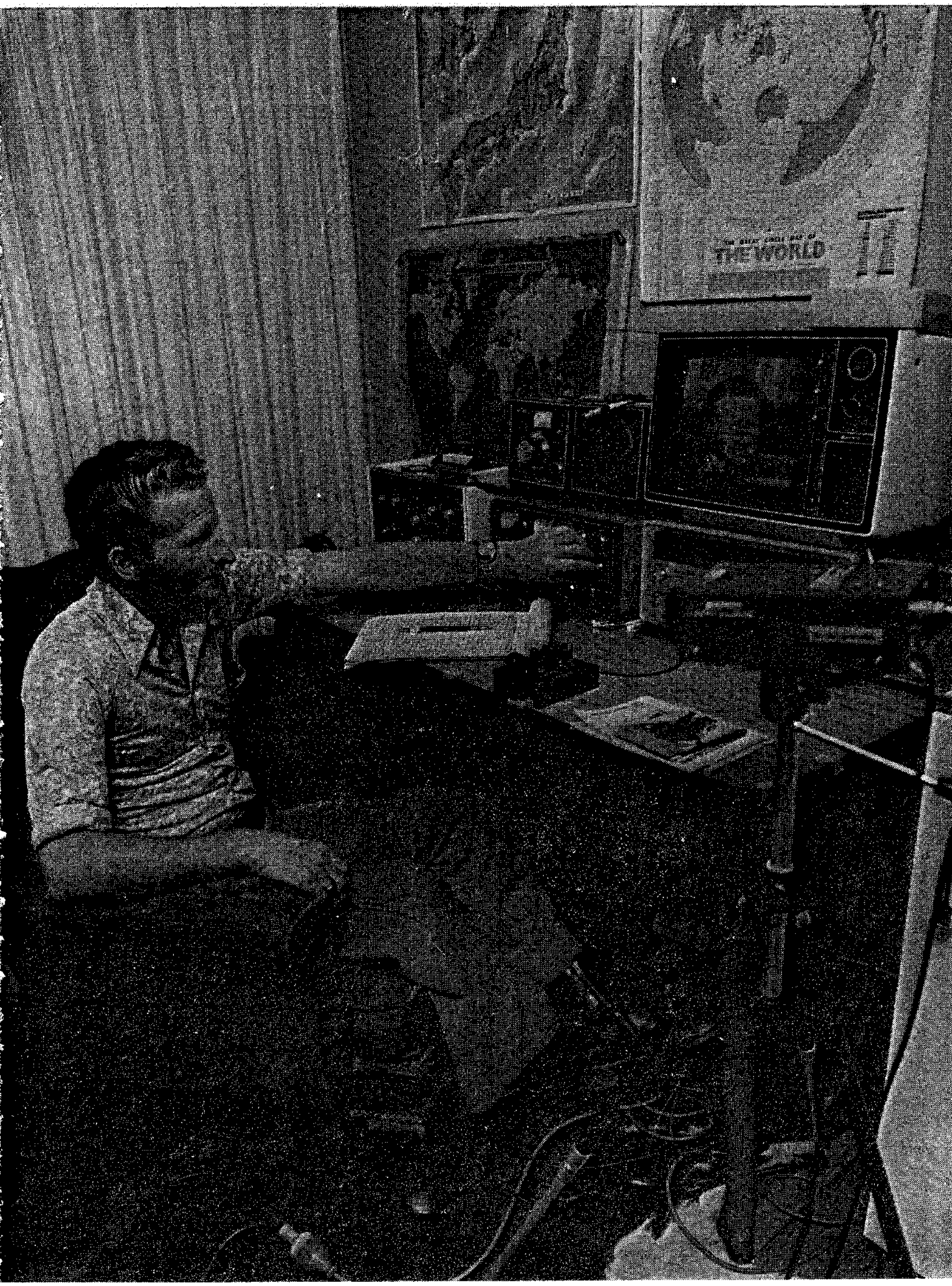
NARROW-BAND VOICE MODULATION

This is a new and fairly sophisticated development of voice transmission which deserves a brief mention here. Speech is electronically converted and transmitted in very much reduced bandwidth which causes less interference to other amateurs on the same band.

MORSE CODE (CONTINUOUS WAVE)

Morse Code is basically turning your transmitter on and off with a morse key to produce dots and dashes or more correctly "dits" and "dahs". It is effective for long distances and it is the simplest and cheapest form of transmitter.

A morse code transmitter can be modified to transmit AM voice signals and AM sets can be easily modified to transmit morse code. This means that you could use AM for local communications and morse code for longer distances. The lower portion of each amateur band is specially set



An SSTV operator adjusting his camera and picture quality before transmission.

aside for world wide morse code transmissions. It is therefore important to know what frequencies you can use for what type of transmissions on each of the amateur bands. (See Chapter Seven.)

(See page 61 for correct Morse Code operating procedures.)

AMATEUR TELEVISION

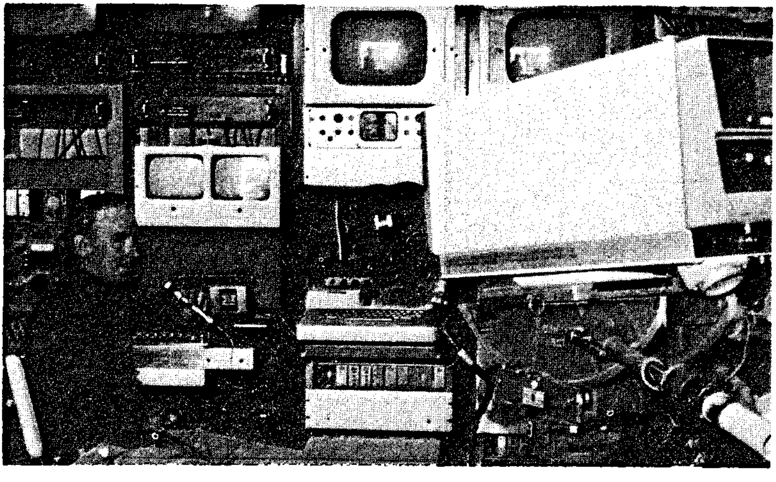
With Amateur Television, popularly known as ATV, not only can you talk to someone but you can see them too. And they can see and hear you.

ATV is similar to your home television set. However, instead of transmitting commercial programmes, you use your ATV station to make a two-way contact with other amateurs — it's like a two-way video telephone.

You could aim your TV camera at yourself, for example. You might be sitting behind your table (just like the bloke who reads the news on TV) with your station call sign displayed. You could even walk around your shack and point out interesting bits of gear or aim the TV camera at members of your family, the pet dog or even at the view outside your window.

Because the sound on ATV is restricted to the very high frequencies and above and because the accompanying TV picture transmission is similarly restricted, you will find that the range of your two way ATV signals is about the same as commercial TV stations, i.e. around two hundred and fifty kilometres. This range can sometimes be greater, up to about five hundred kilometres, given exceptionally good communication conditions.

Amateurs use both black/white and full colour television transmissions. For about thirty dollars you can add a converter onto any ordinary TV set and this will allow you to pick up amateur TV stations operating on



No, this is not a commercial TV studio . . . just a very keen ATV operator!

An inventive Australian amateur often transmits this card to encourage budding SSTV operators.

the UHF amateur bands or, if you already have a UHF TV set, tune in to channel thirty three or channel thirty four.

All you need to do now is set up your television transmitter which will include your camera. This could all cost between one hundred and three hundred dollars depending on what bargains you can come by.

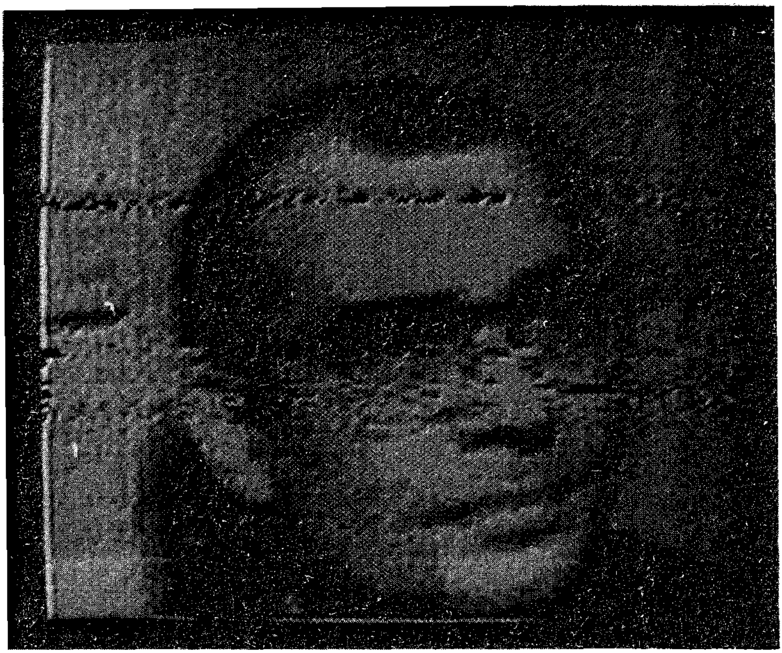
(See page 143 for correct ATV operating procedures.)

SLOW SCAN TELEVISION

Whereas Amateur Television is an instant transmission of *moving* images, Slow Scan Television (SSTV) takes about eight seconds to transmit a still image. For example, if you want to transmit a photo or any non-moving object then all you do is point a camera at that object for the eight seconds required for transmission.

Because SSTV is not restricted to any frequency band it is very popular on the High Frequency bands where you can exchange images and photos with amateurs overseas. You can transmit pictures of your family, QSL cards (see page 151), diagrams etc. The Americans even relayed photo's of Mars as the two Mariner space craft approached the planet — allowing amateurs all over the world to see these historic shots on their SSTV gear.

SSTV is really quite a simple process. A photograph or still image is scanned by an SSTV camera whose purpose is to convert the visual picture into two sounds (one sound for black, the other for white). These sounds are played into an ordinary transmitter and sent out over the



A Slow Scan picture transmitted from South America and received in Australia.

airwaves to be picked up by an SSTV receiver which unscrambles the sounds back into picture form.

To receive SSTV pictures you need an SSTV monitor scope. Such a system can be built for about fifty to one hundred dollars and is simply connected to the loud speaker terminals of an ordinary amateur radio receiver.

Since SSTV is a *sound* system you can make good use of your ordinary cassette player. This is how it works — use the cassette player to record the sounds produced by the slow scan camera then, when you actually wish to send the picture, you simply play back the recorded sounds into the transmitter's microphone.

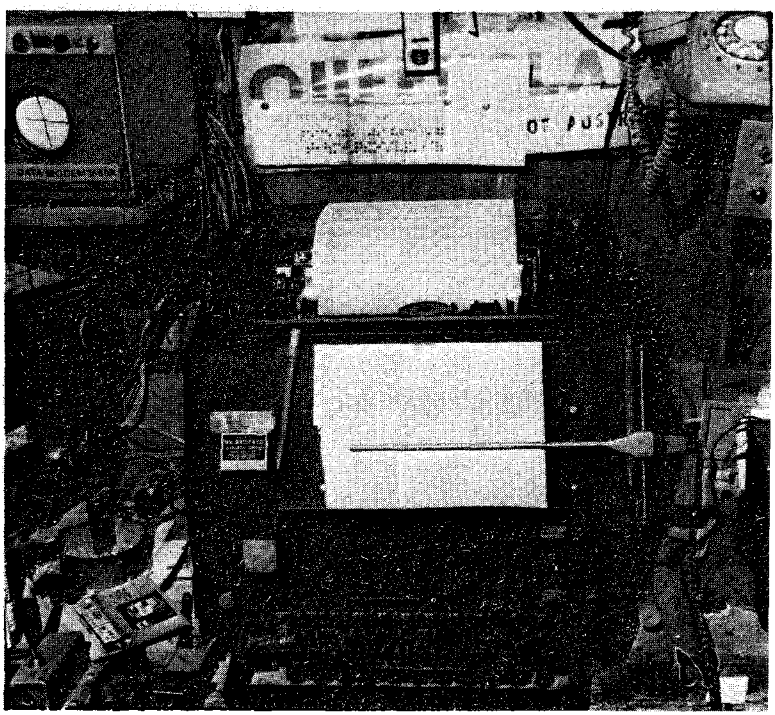
Of course, if you don't own a slow scan camera but have a friend who does . . . well, hurry on down to his place and you can be transmitting SSTV all for the cost of a simple cassette recorder! Most SSTV is black and white only, but colour is in its infancy and growing fast.

(See page 143 for correct SSTV operating procedures.)

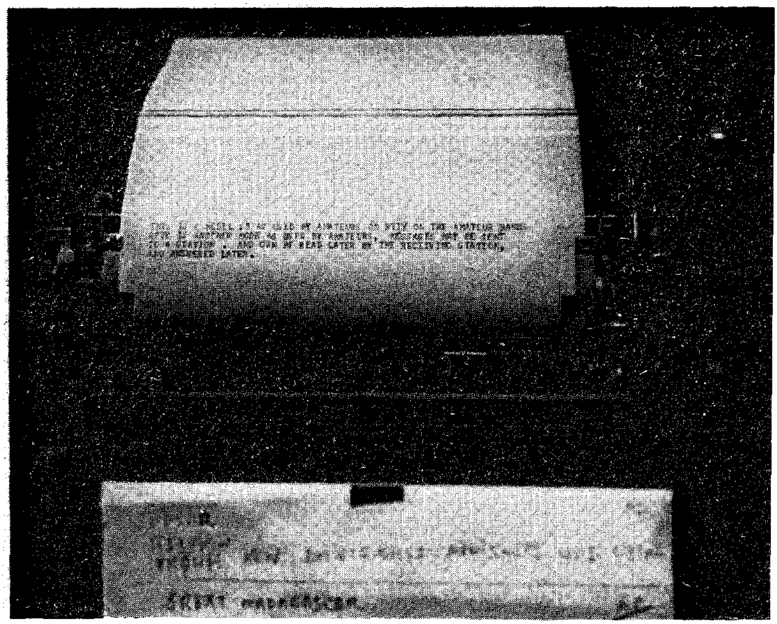
RADIO TELETYPE

Radio teletype (RTTY) is just as simple and as much fun as SSTV.

Basically, RTTY allows you to send or receive a printed rather than a verbal message. This is particularly useful if you want an accurate written record of a contact. Or, if you're not going to be home for a while, your RTTY teleprinter will take down any messages for you.

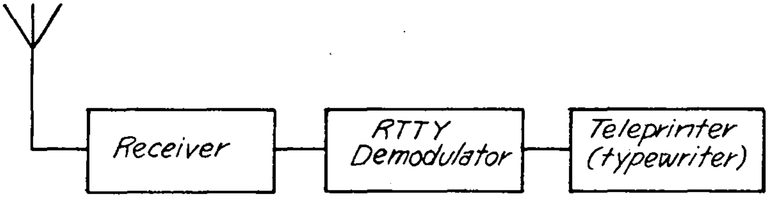


This is a model 15 teleprinter as used by amateurs for the transmission and reception of RTTY.



A close-up of the machine's printing mechanism.

To receive radio teletype you need a radio teleprinter which can be picked up for around fifteen dollars, if you're lucky. The teleprinter is connected to an ordinary receiver through an RTTY demodulator.



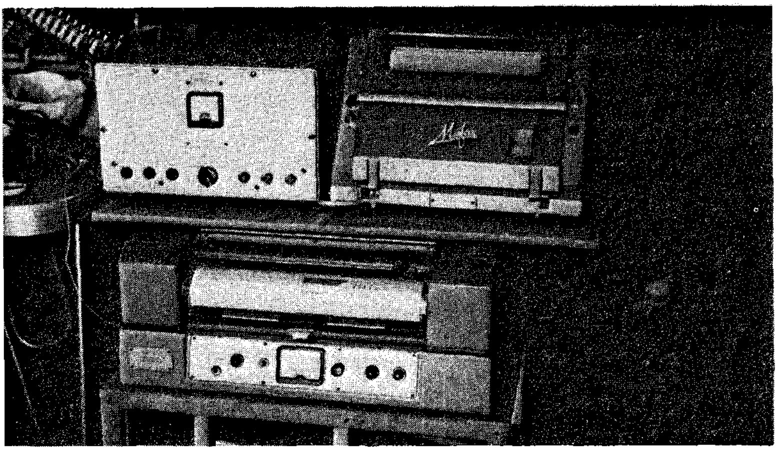
When someone types out a message on their teleprinter (similar to a typewriter) your teleprinter receives it and prints it on a paper roll.

To transmit radio teletype, your teleprinter is connected to your transmitter through a simple circuit. All you do now is press the keyboard on your teleprinter and you're away with RTTY.

(See page 144 for correct RTTYoperating procedures.)

FACSIMILE

Facsimile, often called FAX is really a cross between SSTV and RTTY. It allows the transmission of detailed maps, circuit diagrams, drawings, photographs and other stationary images.



A complete facsimile set up.

The material containing the printed or handwritten material is placed on a special revolving cylinder. A very narrow light beam is reflected from the material and picked up by a photoelectric cell which causes a changing sound to be produced. This sound can then be transmitted.

At the receiver the sound is converted into a picture of the original material reproduced on either a heat sensitive, light sensitive or current sensitive paper.

Chapter

3

Licensing Requirements

Licensing Requirements

There are three levels of amateur licences:

1. The NOVICE amateur licence
2. The LIMITED amateur licence
3. The FULL amateur licence

The word amateur used on its own refers to a person holding any of the three levels of amateur licences. An applicant for a licence must sit for an examination conducted by the Department of Communications. The exam fee for any level amateur licence is two dollars.

(A summary sheet of exam requirements and dates is given on page 36 but let's go into more detail first.)

The exams basically exist to ensure that those who become amateurs are really interested in radio as a hobby and are willing to operate on the international amateur airwaves in an orderly and safe manner without causing interference to other hobbyists or services.

THE NOVICE AMATEUR LICENCE

If you're getting started in amateur radio and you don't know anything about it at all, then this is currently the easiest amateur licence you can obtain.

This licence is designed to put you on the air quickly. When you have been operating for a while and feel you have learned more about radio, then you can try to obtain a higher level amateur licence.

The novice licence allows you to talk with radio hobbyists around the world on three of the amateur bands:

- on 80 metres using any frequency from 3.525 to 3.625 MHz
- on 15 metres using any frequency from 21.125 to 21.2 MHz
- on 10 metres using any frequency from 28.1 to 28.6 MHz.

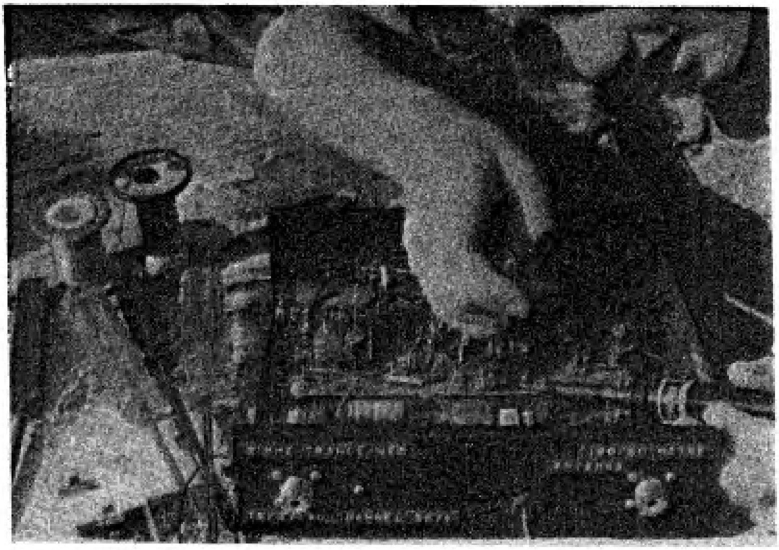
There is no restriction on the type or height of antennas. You can even build your own. But check that you comply with local council regulations.

There is no restriction on the type of transmitter you can use. Again, you can build your own equipment if you like.

You can operate from a car, home, boat, plane — or, if you're lucky, walking up the main street of Sydney talking to Japan on a handheld.

A power output of thirty watts on SSB (voice transmissions), ten watts on AM, FM (voice) and CW (morse code) is permitted.

You can make adjustments, modifications and additions to your equipment.



Modifying an 80 metre transverter onto some of the other amateur bands.

A novice cannot transmit Slow Scan Television, RTTY or ATV.

The licence fee is $10.00 per year — and there is no restriction on the number of transmitters you can own.

There is no age limit.

There is no time limit on how long you can hold your novice licence. All you need to do is pay $10.00 each year to renew your licence.

THE NOVICE EXAM

The examination consists of three parts:

1. *Knowledge of the official Amateur Radio Regulations*

This exam consists of a thirty minute test with thirty multiple choice questions.

You are given four possible answers to each question and you must circle the one which you think is correct.

You will need a 70% pass which means you only need to get twenty one questions correct.

(I told you it was easy – but it's always best to aim for 100%.)

For study purposes a copy of the Amateur Radio Regulations is available from the Department of Communications in your State for $3.60.

N.B. *Once you have passed the Novice exam you don't need to do the Regulations exam again when you sit for the Limited or Full exam.*

2. *Morse Code Exam*

You need to be able to send and receive morse code at a speed of five words per minute. (For International Morse Code Symbols see page 164.)

In the *receiving exam* you are seated in a room with a group who are all taking the morse test. You listen through headphones to the tape recorded morse.

The first morse signals sent are to allow you to adjust your headphones, give you a bit of preliminary practice and to make you feel a little more at home.

Then you are told to get ready to receive the actual exam. You are allowed no more than ten errors to pass the morse receiving exam which is conducted for five minutes.

If you miss out anything, leave a blank space — do not put a stroke in its place, since this itself is a morse code character. If you have made an error do not cross out what you have written because no corrections are allowed.

The five minutes worth of morse consists of an equivalent of twenty five words (averaging five letters per word) in letters and numbers (each number counting as two letters).

A maximum of three errors is counted in any one word or group of numbers.

In the *sending exam* you sit in front of the examiner, with headphones so that you can hear what you are sending. You are allowed to practice with the key — adjust it and get the feel of everything. Then you are told that you can start sending the test passage which is written out in front of you.

If you make an error you must use the proper procedure to correct the error. Errors are corrected by firstly sending eight "dits" meaning "error" and then sending the last correctly sent word or group of numbers again before correcting your error.

You are allowed up to four errors in the sending exam which consists of about twelve and a half words (averaging five letters per word) in letters and numbers (each number counting as two letters). The exam is conducted for two and a half minutes.

3. *The Novice Theory Exam*

The novice theory covers an elementary newcomer's understanding of how to operate radio equipment and what makes it all tick.

You are given fifty multiple choice questions with a possible four answers for each question. You simply have to circle which answer you think is correct.

You are allowed *1 HOUR* to answer the questions.

You need 70% to pass the novice theory exam.

(See page 169 for a sample list of questions from a recent exam.)

N.B. If you fail one or more sections of the novice exam and pass others then, in your next attempt, you need only sit for the section in which you failed — but all sections must be passed within a one year period.

STUDYING FOR THE NOVICE EXAM

A whole range of material is available to help you understand the things you need to know to pass the novice theory exam.

One of the best is the WIA Self Study Novice Kit. This contains two C60 cassette tapes which teach you morse code and take you up to five w.p.m., a sample of a thousand questions for the novice theory and regulations exam, the well known Westlakes Radio Club Novice Theory Manual, study hints, an introduction to electronics booklet and the address of an amateur willing to answer questions sent through the mail.

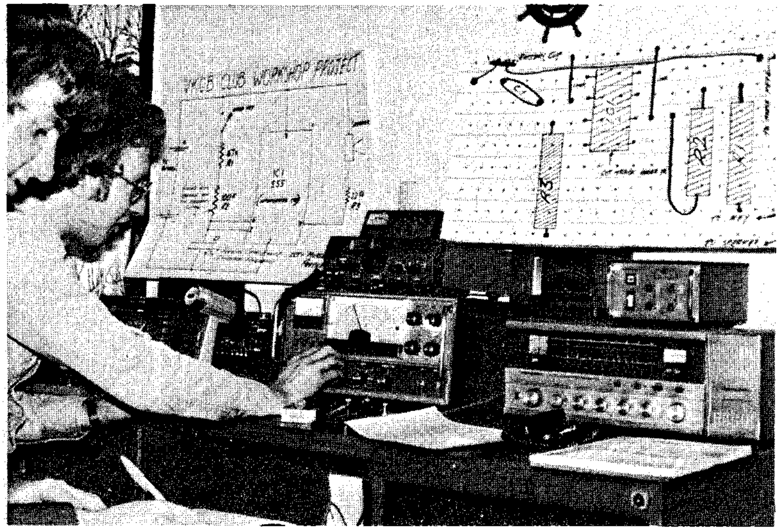
This kit can be obtained by sending fifteen dollars to A. Wilson, WIA, 19 Lancaster Street, Blacktown, NSW 2148.

Classroom courses are also conducted by volunteer instructors to assist newcomers to study for the novice licence. In Sydney, the Novice Amateur Radio group conduct a novice course each Saturday afternoon at the Wireless Institute of Australia from one to five p.m. This is typical of the many courses voluntarily conducted by amateurs within radio clubs — it consists of typically sixty to one hundred students at a time. Cost is ten dollars to fifteen dollars approx. For further information contact the WIA in your State. (See page 160 for list of WIA addresses.)

Evening novice courses are available at certain *Technical Colleges* for between thirty dollars to sixty dollars. Make enquiries in your local area.

Morse Code Study

For morse code you should try to get access to an 80 metres receiver to pick up the daily WIA morse practice broadcast (see Chapter 7 for details of times



Many amateur operators give their time free to teach new radio club members the basics of radio operation and theory.

and days) or use morse practice tapes. A variety of cassettes and tapes are available from A. Wilson. (See page 31 for postal address.) Most electronic dealers sell similar cassettes.

TRIAL EXAMS

The Youth Radio Service (YRS) conducts Novice trial exams in centres around Australia to give candidates a taste of what the real thing will be like. Contact A. Wilson — see page 31 for postal address.

THE LIMITED AMATEUR LICENCE

The limited amateur licence is the same as the full amateur licence except that there is no morse code exam. This level of licence allows those who do not know morse code but who can pass a full amateur theory exam, the opportunity to enjoy amateur radio.

The limited amateur licence allows you to operate on the amateur bands at 52 MHz and above, i.e. in the VHF, UHF and SHF amateur bands only.

A power output of four hundred watts is allowed on SSB (voice) and one hundred and fifty watts on AM and FM (voice). However, no morse code (CW) operation is allowed.

The licence fee is $15.00 per year. There is no time limit on how long you can hold a limited licence. All you do is pay $15.00 a year.

LIMITED AMATEUR EXAM

The limited exam consists of an exam in radio theory which is at a higher level than the novice theory exam. It is a multiple choice question style exam.

Since there is no morse code exam for the limited licence you are not allowed to operate on some of the lower frequencies which the novices can use. If you wish to join them, all you have to do is sit for the Novice five words per minute slow Morse Code exam.

THE FULL AMATEUR LICENCE

This licence is the ultimate achievement for the person interested in radio as a hobby.

As well as being able to operate on the novice and limited amateur bands, many other additional frequencies and bands are available to the fully licenced amateur. The full licence permits use of all available HF bands as well as the most diverse range of activities open to the radio hobbyist.

A power output of four hundred watts on SSB (voice) transmissions as well as 120 watts on AM and FM (voice) and morse code is permitted.

The licence fee is $15.00 per year.

FULL AMATEUR EXAM

The exam is the same as the limited amateur exam except that there is an additional exam in morse code at a speed of ten words per minute. Therefore if you have passed the limited exam all you need do is sit for the ten word per minute morse code exam.

It is quite acceptable to sit for the full licence exam without having done the novice or limited exam, which means passing the regulations, full theory and the 10 w.p.m. morse code exams.

STUDYING FOR THE LIMITED AND FULL LICENCE

If you obtain copies of the exam papers over the last ten years, you will see that many of the essay type of theory questions in the full and limited exam papers repeat themselves year after year. Copies are available free of charge from the Department of Communications in the capital city of your State. Past exam papers will give you an excellent idea of what you should study.

Look up the answers to each question — if a circuit is required, then find the simplest circuit and memorise how to draw it. Go on — draw it a few times — you will see how easy it is to learn. Be able to describe generally how that circuit works.

The best study books are the *ARRL Radio Amateur's Handbook* and the *RSGB Radio Communications Handbook*, both available at good electronic stores.

Don't let these thick books frighten you. They are good reference but you don't have to learn every single word they contain to pass the exam.

Be guided by your collection of full and limited exam papers. Sort out the questions into general areas such as power supplies, transmitters, receivers, antennas, test equipment, interference, radio wave propogation etc. and look up the index in the two books to find the clearest description and simplest diagrams.

Getting you morse code up to ten words per minute is simply a question of practice — so keep at it!

RESPONSIBLE INVOLVEMENT

The Australian amateur licensing structure aims to encourage you, as a newcomer, to become responsibly involved in the hobby of radio. Once you obtain your novice amateur licence, a whole range of incentives in the form of extra power privileges and exciting additional frequencies are offered to encourage you to obtain your limited and finally your full amateur licence.

On the airwaves, full, limited and novice are all regarded as amateurs

— everyone is interested in the same hobby and you will find that your motivation and enthusiasm will grow as you become more intrigued by the wonders of worldwide amateur radio.

(I reckon Boris probably has a similar sort of licensing system in the USSR. Or maybe it's different in Siberia?)

PRACTICAL EXPERIENCE

Even if you don't have an amateur licence you can legally operate an amateur transmitter provided that a licenced amateur is supervising the operation.

In fact it's a very good way to start off. The licenced amateur can show you exactly what to do and how to speak on the radio.

If *you* do anything wrong, the licenced amateur takes the full responsibility — *so never abuse this privilege.*

(A bit of personal advice: try and meet a few of the amateurs who live near you. You'll be amazed how most people will go out of their way to help you with any problems you might have during your studies.)

STRANGE ANTENNAS

Look out for strange antennas on your street block — it could be an amateur. If you catch them at the right time and they see that you are really keen on radio, you might get an invitation to say a few words over the airwaves.

You can even look up the amateur radio call book which has addresses for amateurs all over the world — and see if anyone lives near you.

Why not knock on the door and say something like, "Hello, my name's Dick Smith. I live at Artarmon just near you, and I'm very interested in radio. Would you have some free time to show me how you run your shack?"

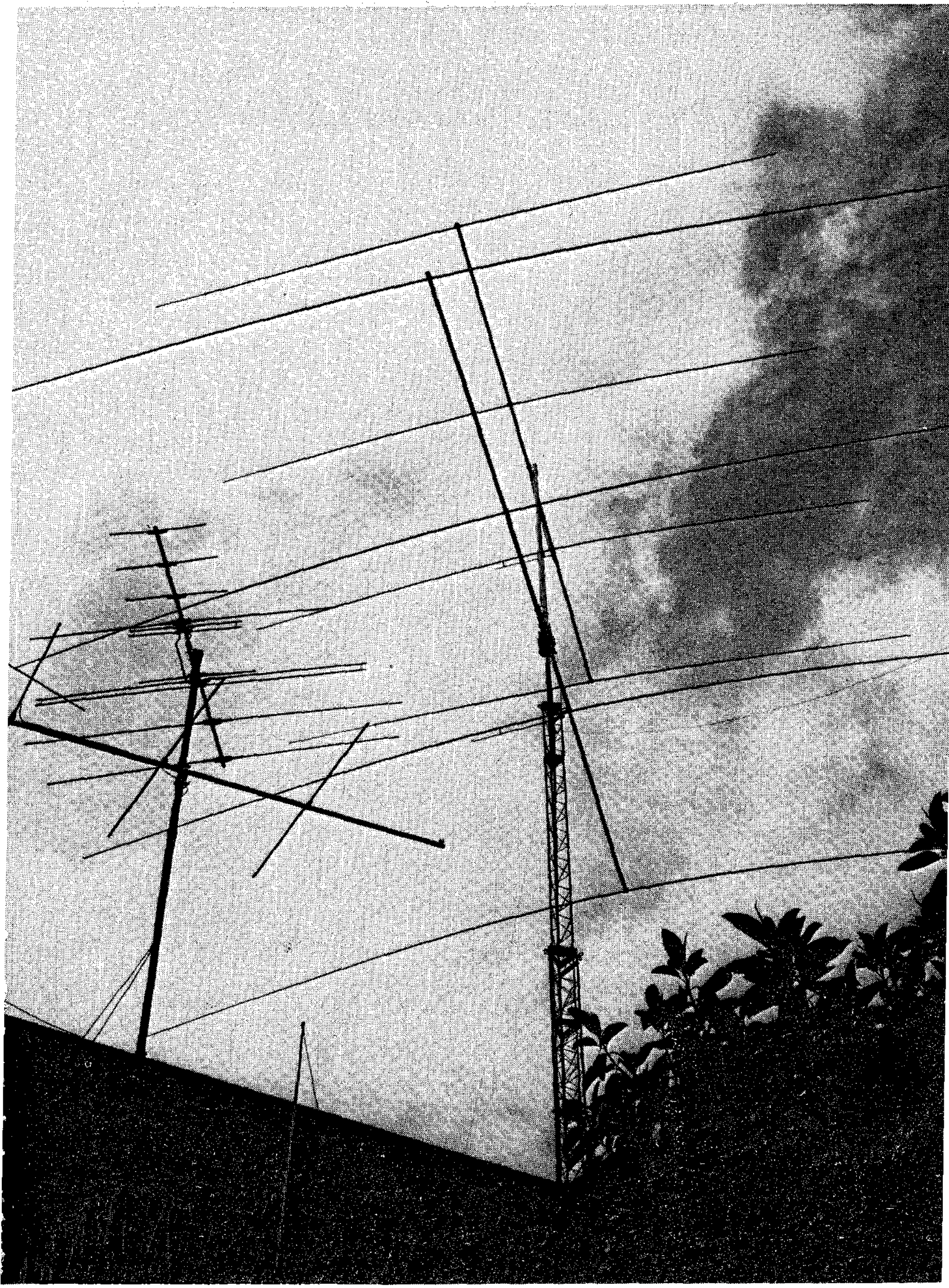
(Honestly, that's the way I started to learn about amateur radio when I was only nine.)

CALL SIGNS

There are many hundreds of thousands of radio amateurs around the world in virtually every country. To easily identify a person, each licenced amateur radio operator is given a call sign, VK2ZIP for example.

The first two letters (VK) signify the country, i.e. Australia, the number signifies the region within that country, i.e. the state of New South Wales, the next letter signifies the type of licence (N is the Novice, Z or Y is for Limited and A, B, C are for Full). The last two letters identify the individual person within that country and region. (See page 166 for the internationally recognised letters representing the various countries in the world.)

(P.S. If you do hear VK2ZIP on air, give me a call and say hello.)



The TV antenna in the foreground is dwarfed by the large 4 element 20 metre and 4 element 10 metre beams atop the tower.

THE AUSTRALIAN AMATEUR EXAMS AND LICENCES SUMMARY

	NOVICE	LIMITED	FULL
EXAM REQUIREMENTS	Regulations Elementary theory Morse at 5 w.p.m.	Regulations Advanced theory	Regulations Advanced theory Morse at 10 w.p.m.
BANDS ALLOWED	Part of the 80, 15 and 10 metre amateur bands	Only 6 metres through to 1.25 centimetres	All amateur bands — 160 metres right through to 1.25 centimetres
MAXIMUM POWER	30 watts on SSB voice 10 watts on AM, FM, CW	400 watts on SSB voice 150 watts on AM, FM	400 watts on SSB voice 150 watts on AM, FM, CW
MAIN EXAM DATES	(i) 3rd Tuesday in May (ii) 3rd Tuesday in November	(iii) 3rd Tuesday in February (iv) 3rd Tuesday in August	The same as for Limited
YOU MUST APPLY TO SIT FOR THE ABOVE EXAMS BY	(i) 8th day of April (ii) 8th day of October	(iii) 8th day of January (iv) 8th day of July	The same as for Limited
ADDITIONAL EXAMINATIONS IN REGULATIONS	Apply to sit for the Feb. or August full or limited exam — and only attempt the regulations section of that exam	Apply to sit for the May or November novice exam — and only attempt the regulations section of that exam	
ADDITIONAL EXAMS IN MORSE CODE	3rd Tuesday in February and August at 5 w.p.m.		3rd Tuesday in May and November at 10 w.p.m.
YOU MUST APPLY TO SIT FOR THE ABOVE EXAMS BY	At least two weeks before the above dates	At least two weeks before the above dates	At least two weeks before the above dates

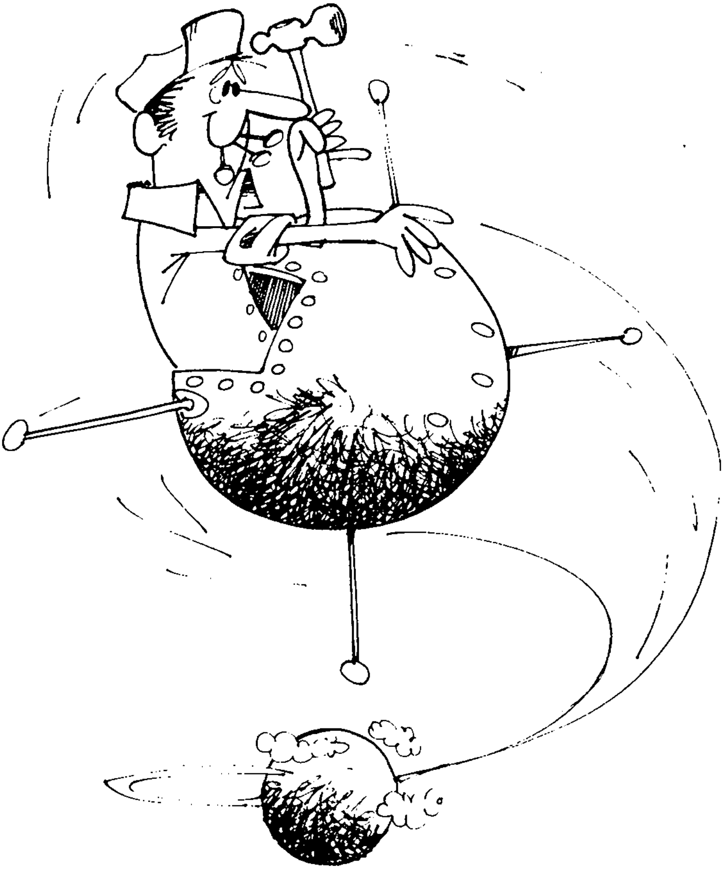
NOTE: The main exam date and the date by which you must apply is indicated by the numbers (i) (ii) (iii) and (iv)

The Department of Communications makes special arrangements for handicapped people to take exams.

Chapter

4

Man Made Aids for Radio Communication



Man Made Aids for Radio Communication

Radio is one of nature's marvels but man, being the curious inventor he is, could not resist adding to nature's own creation.

Marconi's first radio transmission made use of a totally natural phenomenon, but today's advanced technology has introduced man-made aids to combine with nature in order to achieve longer range and better transmission.

RADIO BEACONS

The worldwide radio beacon system is a good example. Radio beacons are amateur transmitters operating twenty four hours a day on a specific frequency in various countries of the world.

If you are able to hear the beacon in Hawaii, say, there is a very good chance that conditions are such that you could say *aloha* to someone in Waikiki. (See Chapter 7 for details of beacons with call signs and frequencies.)

REPEATER STATIONS

Repeater stations are another example of man's ingenuity.

A repeater is a radio station consisting of a transmitter and receiver stiuated in a high location. The repeater is able to receive signals from low power amateur transmitters and re-transmit their signals very strongly over 250 or more kilometres. Without these repeaters to boost the coverage of signals, low power amateur transmitters would have limited range especially when operating mobile or handheld equipment on the VHF, UHF and SHF bands.

(For further details on repeaters see Chapter 7. For repeater operating procedures see page 137.)

SPACE SATELLITES

Using space age technology, amateur communications satellites have been put into orbit around the earth. These satellites, popularly known as OSCAR (Orbiting Satellites Carrying Amateur Radio) allow amateurs with simple equipment to establish long distance VHF contacts.

The satellites have been designed to receive signals on one frequency band and retransmit that signal onto another frequency band.

Amateurs in any country can transmit to the satellite on a frequency in

OSCARTRAK SATELLITE LOCATOR KIT

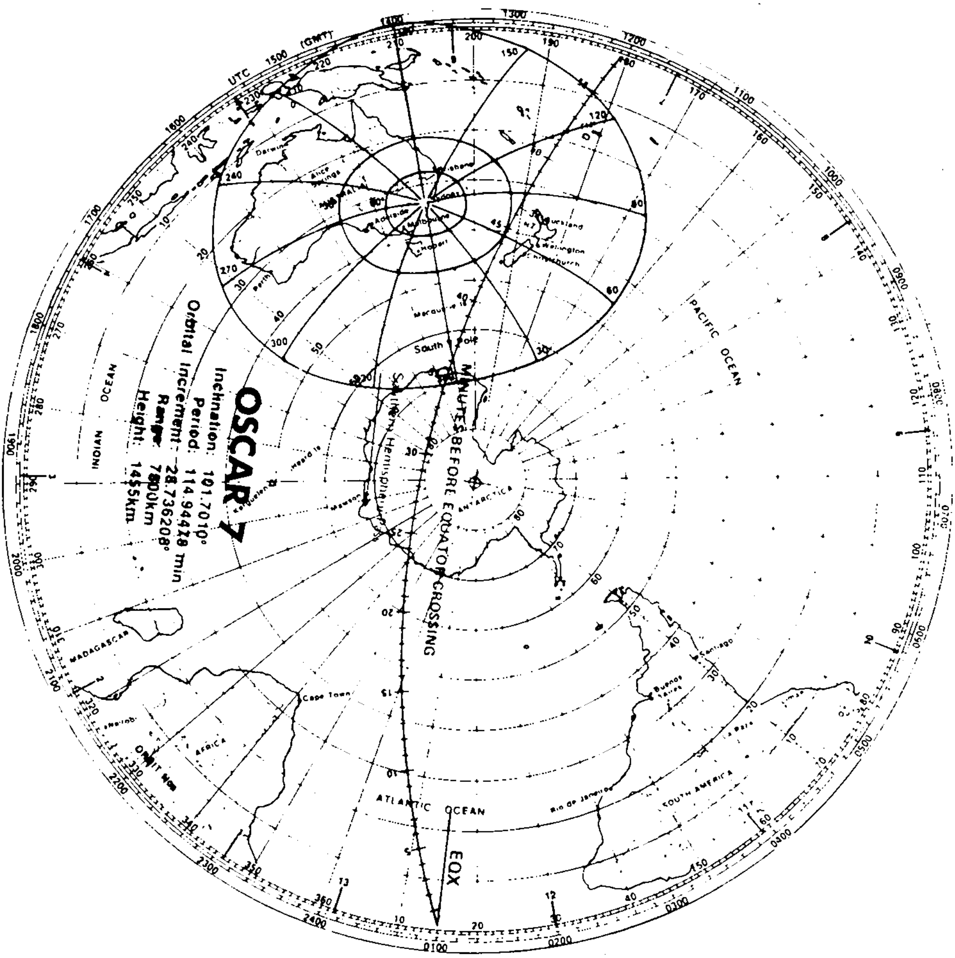


Diagram: Electronics Australia

You can track the Oscar 7/8 series of amateur satellites with the help of a kit giving an excellent pictorial display. The illustration shows the Oscar 7 locater set up to indicate a satellite track passing from north to south between Australia and New Zealand.

the 2 metre band and the satellite will re-transmit that signal down onto the 10 metre band so that you can actually hear yourself talking!

The frequency on which your signal goes into the satellite is called the uplink and the frequency on which the signal comes out of the satellite is called the downlink.

All you need is a transmitter broadcasting on the satellite's uplink frequency and a receiver tuned to the satellite's downlink frequency. (See Chapter 7 for details on satellite frequencies.)

Satellites Oscar 7 and Oscar 8 are the two American launched amateur satellites currently operating. A continuous signal is transmitted from each satellite so that when it is above the horizon you will hear it on its "beacon" frequency.

The two Oscars usually pass over Australia three times daily and are controlled by Amateur Command ground stations. These command stations can signal the satellites to shut down if the battery voltage level aboard the satellite is dangerously low and they can also command the satellite to operate on different amateur bands.

At present transmission through a satellite is possible for about twenty minutes at a time until it disappears over the horizon. However, new satellites with special shaped orbits are currently planned. These will give continuous reliable coverage for up to 18 hours a day.

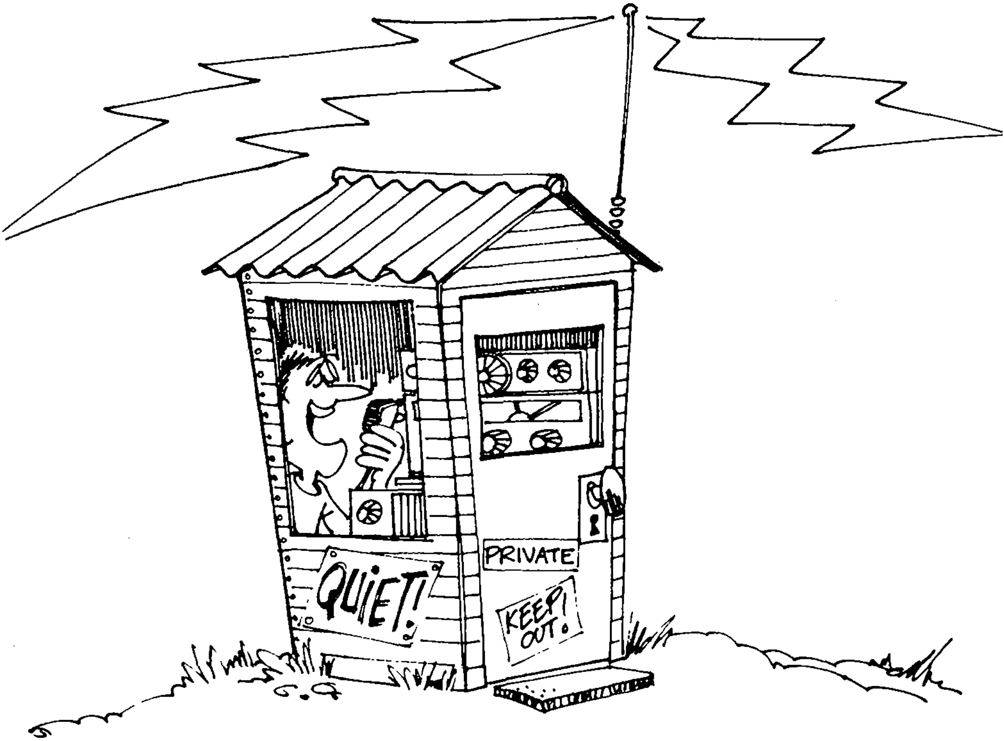
The Russians are also launching a series of new satellites known as the RS series.

(Good on you, Boris – I knew you were a good mate! Who's your contact at the Kremlin?)

Chapter

5

What Makes A Radio Shack Tick


QUIET!
PRIVATE
KEEP OUT.

What Makes
A Radio Shack Tick

Congratulations! Your amateur radio licence has just arrived in the post box and you're all set to get on the air. Well, just about — all you need now is a transmitter, a receiver and an antenna. (Antennas deserve a separate chapter all to themselves. See page 105.)

To build or buy? That's the first question you'll have to answer. Some people buy the whole radio shack from transmitter to antenna and get on air instantly. Others prefer to build their own from scratch — this is called 'homebrewing' in radio jargon.

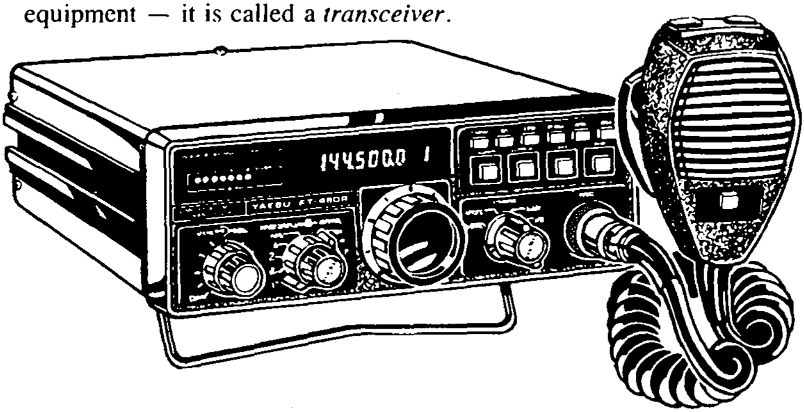
Then, of course, there is the compromise situation where you can start 'homebrewing' by adding to or refining the basic equipment you bought.

In any case, the choice is yours. But before you decide let's take a look at the essential ingredients that will make up your amateur radio station.

The *receiver* allows you to receive or pick up either peoples's voices or signals.

The *transmitter* allows you to transmit or send out radio waves which can carry your voice or Morse Code signal over certain radio frequencies.

When both the receiver and transmitter are contained in one piece of equipment — it is called a *transceiver*.



An extremely sophisticated 2 metre all mode transceiver featuring a computer operated central processing unit which performs complex control operations at the flick of a switch.

THE RECEIVER

There are many types of receivers. For example, there are some which only cover specific bands such as the marine or amateur or aircraft bands.

Other receivers cover a whole variety of different bands on the one radio and are known as communications receivers.

If you want to pick up the novice bands, then make sure that your receiver covers all of the 80, 15 and 10 metre novice amateur bands. If you are expecting to get your full licence then make sure the range 160 through to 10 metres is covered.

Receivers are made to pick up *certain types of transmissions.* Some only receive AM voice, others only SSB voice on both upper sideband (USB) and lower sideband (LSB) while others will receive AM, USB and LSB on the one receiver.

The basic novice receiver should at least be able to cover these types of transmissions. Such a receiver normally includes a coverage of CW or morse code reception as well.

FM is a popular mode on receivers which are designed to cover 52 MHz and above.

Let's look at some of the important features of any receiver:

Selectivity

If two stations are transmitting close to the same frequency, then your receiver should be able to tune in one of the stations without receiving interference from the second unwanted station. This ability to separate stations on a receiver is called *selectivity.*

Sensitivity

The ability to hear a very weak station on a radio receiver is determined by the *sensitivity* of the receiver.

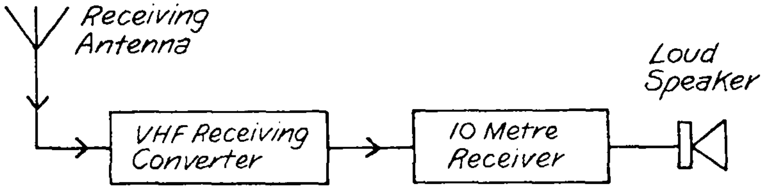
THE TRANSMITTER

It is fairly obvious that the transmitter you choose must match the receiver — in other words, the frequency range and types of transmission must be the same for both.

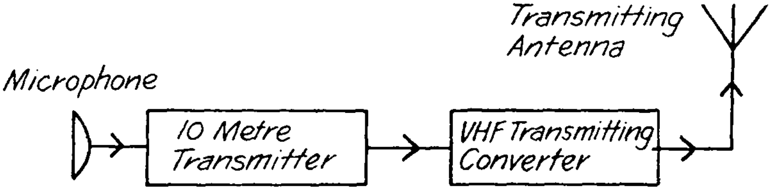
THE VALUE OF A CONVERTER

If you have a receiver which does not cover the frequencies you would like to listen into, then a converter can be connected between your receiver and your antenna which will allow you to pick up other frequency bands.

This type of converter is called a *receiving converter.* The diagram below illustrates VHF waves being received through a 10 metre receiver.

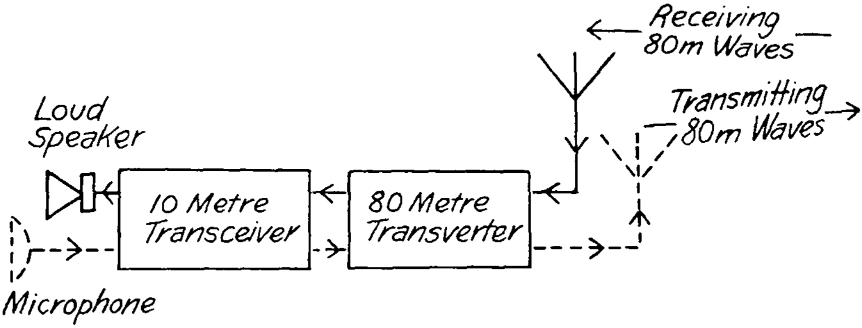


The same principle works in reverse. The diagram below shows how a *transmitting converter* allows you to transmit VHF waves through a 10 metre transmitter.



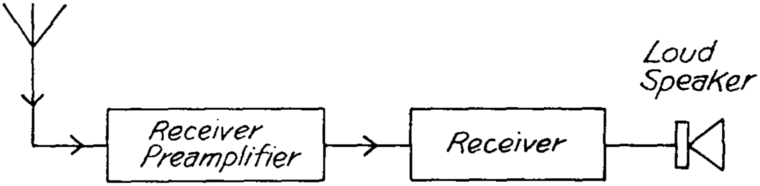
WHAT IS A TRANSVERTER?

Say you have a transceiver (that is, a transmitter and receiver all in one piece of equipment) and it's operating on 10 metres, but you would like to talk to people on 80 metres — so you would need a receiving converter and a transmitting converter — right? . . . Right! O.K. Well, if both these converters are contained in one piece of equipment it is called a transverter. The following diagram illustrates the principle. The transverter is connected between your transceiver and your antenna.



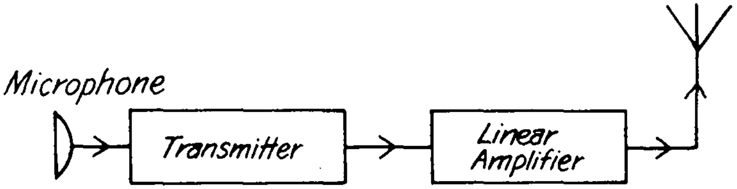
RECEIVER PREAMPLIFIER

A receiver preamplifier is connected between the antenna and the receiver to make weak signals stronger. That is, a receiver preamplifier *amplifies* the signals coming from the antenna.



LINEAR AMPLIFIER

A linear amplifier is connected between the antenna and the transmitter and is used to boost the power of your transmitter.



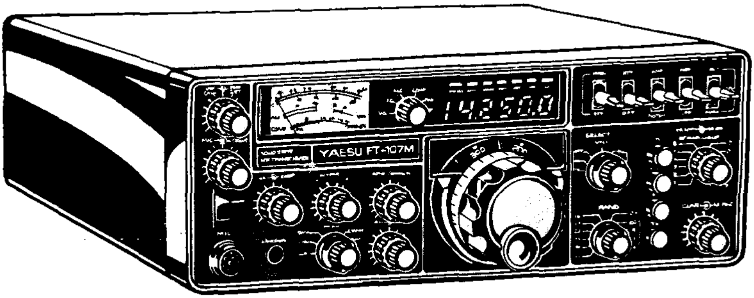
Linear amplifiers and RF (radio frequency) power amplifiers (PA) are available for use with multi-band transceivers on HF or for single band use on the 6 and 2 metre and 70 and 23 centimetre bands. Amplifiers for the other UHF and SHF bands are available in the form of ex-military type equipment.

SELECTING THE RIGHT MULTI-BAND HF TRANSCEIVER

Some transceivers are specially made for both mobile and home use. They are designed to operate from both a 12V supply (such as a car battery) and the 240V AC mains supply. Other transceivers are made specifically for mobile, portable or home operation. Some transceivers do not include AM reception or transmission. You can listen to an AM signal on an SSB receiver but you cannot transmit AM.

Some multi-band HF transceivers do not cover 160 metres. This band can be added by building a transverter, say to transvert 80 metres onto 160 metres.

Some transceivers are fully transistorized while others contain a few valves. Transistorized sets draw less current from your battery but power amplifying valves are cheaper to replace.



An all mode/all HF band top of the line transceiver that does everything except sing and dance . . .

CONTROLS ON A TYPICAL MULTI-BAND AMATEUR HF TRANSCEIVER

On a multi-band HF transceiver many controls are required to allow you to adjust your equipment to peak performance on a whole range of amateur bands from 160 through to 10 metres.

Drive or Pre-selector, Plate and Load Controls

In a transceiver the Drive or Pre-selector Controls are used to tune both the receiver and transmitter for maximum performance. The receiver is tuned for maximum sensitivity and the transmitter is tuned for maximum radio frequency signal into the amplifying valves, or amplifying transistors.

The Plate Control is used to tune for maximum radio frequency signal out of the amplifying valve or transistor. The Load Control is used to tune for maximum radio frequency current (RF) into the antenna.

In this way the Drive (or Pre-selector), Plate and Load Controls allow you to tune for Maximum RF power output into a suitable antenna using any frequency and band you desire. (A few HF transceivers use a form of broadband tuning that does not require these three controls.)

"Mode" Control

This control allows you to select the type of transmission you desire —

- CW is morse code transmission (continuous wave)
- AM is amplitude modulation voice transmission
- LSB is lower side band voice transmission
- USB is upper sideband voice transmission
- FM is frequency modulation voice transmission
- FSK is frequency shift keying used to transmit radio teletype
- TUNE is used to "tune up" your transmitter on a particular frequency

"Band" Control

This allows the selection of any amateur band from 160 through to 10 metres.

Aux

This means auxiliary position. It can be used to include any future new amateur bands which may become available.

JJY/WWV Position

On many transceivers there is a position on the band selector to which you can turn to tune into the Japanese (JJY) and American (WWV) time signal stations. Both stations provide you with the exact time and, since they transmit on a very accurate frequency, enable you to calibrate your frequency very accurately.

"Carrier" Control

When tuning up a transmitter with the drive, plate and load controls the Carrier Control is used to provide a continuous carrier wave for transmitter tuning. Care must be taken not to advance this control too far initially because if the transmitter is not properly tuned its power amplifying tubes or transistors could be damaged.

The carrier control is also used to vary the power output of the AM voice signal and the CW morse code signal.

Meter

When you transmit, the meter on the transceiver can measure current, voltage and power in the power amplifying section of your transmitter. On receiver, the meter shows the incoming signal strength of the station you're receiving.

IC (or IP), PO (or RF) and ALC Switches

The IC (cathode current) or IP (plate current) switch allows you to see the amount of current being used in the power amplifying tubes by reading the value on the meter. When using AM, CW or tune, you can adjust the current being used by your amplifying tubes to the correct level as recommended in the equipment manual.

The PO (power output) or RF (radio frequency) switch allows you to see on the meter approximately how much radio frequency power you are transmitting.

The ALC (Automatic Level Control) switch allows you to adjust your voice to the correct level for best operation.

Mic Gain Control

The microphone gain control is used on USB or LSB voice transmissions to increase the voice level to produce the power output specified in the transceiver operator's manual.

The manual also explains the correct way of adjusting the MIC gain for AM operating by using the meter to indicate when the MIC gain is at the correct setting.

Clarifier and RIT Control

The clarifier allows you to slightly vary the receive frequency and on some units the transmit frequency also — or to vary both frequencies together. It is very much a fine tuning control. RIT — the "receiver incremental tuning control" is a receiver fine tune control.

"Function" Control

CH 1 and CH 2 indicates positions for fixed frequency crystal locked *channels*.

TX ext. indicates that an *external* VFO to control the *receiver's* frequency can be added.

INT is the *internal* VFO which controls both the receiver and transmitter on the same frequency.

Cal

The *calibrator* switch allows signals at either 25 KHz or 100 KHz to show up on your radio dial. These accurate frequency signals or "markers" allow you to adjust your transceiver onto any exact frequency you may be searching for.

Dial Scale and Frequency Readout Scale

The band control tells you what band you are operating on. This control is either marked in wave length (metres) showing 160 to 10 metres or marked in frequency (megahertz) showing 1.8 to 29.5 MHz.

Dial scales on transceivers are marked in frequencies using kilohertz (KHz) from 0 to 500 or from 500 to 1000.

Since 1 MHz equals 1000 KHz, it's easy to find a given frequency on the dial. Say you want 3.550 MHz. Then you just select 80 metres or 3.5 KHz on your band selector control and on the dial you tune to 550. See how easy it is!

With digital frequency read out scales, all you need to do is select the correct band and the whole frequency in megahertz is displayed in front of you in digital or numerical numbers.

ANL and NB Switches

The Automatic Noise Limiter is often found on CB radios and the Noise Blanker or NS (noise silencer) is found on both multi-band amateur and CB sets. Both are used to reduce noise interference.

AF Gain Control

This control is just a fancy word for volume control. Very handy at midnight when the family is trying to get to sleep.

RF Gain Control

The radio frequency (RF) gain control allows you to vary the sensitivity of your receiver. Very popular when your friend across the road comes on the air using 400 watts on a frequency close to yours. In such a case, you turn down the RF gain of your receiver to minimize the interference to your reception.

RF ATT Switch

The RF attenuator switch is used to decrease the sensitivity of the receiver at a flick of the switch.

MAN or MOX Switch — or Send Switch

The manual switch (MAN) or Manual Operated Switch (MOX) or the Send Switch is used to put the transceiver in continuous transmit. Useful if you intend talking for a while and you don't want to get a sore finger from pressing the microphone transmit button.

Vox Switch

This is the Voice Operated Switch (VOX) and is used to make the transceiver transmit automatically when you are talking. (See page 122 for further information.)

Vox Delay or Vox Relay or Vox Gain

These are variable controls which can be adjusted for proper operation of the Voice Operated Switch.

PTT Switch

This control activates the use of the press to talk (PTT) button on the side of your hand held or desk microphone. (See page 122 for further information.)

Notch Filter and IF (Intermediate Frequency) Shift Controls

These are both variable controls which assist in removing interference caused by stations which are transmitting on frequencies which are very close together. These controls only affect the receiving section of your transceiver.

Comp Level and Processor Controls

The compression level and processor controls are used to keep your voice level constant so that if you speak softer or louder into the microphone it automatically compensates to maintain a near constant voice level by the time it gets processed and transmitted. This means that you don't need to talk really close into the microphone to keep your voice level high and constant.

Side Tone Switch

This allows you to hear your morse code transmissions while you send them.

Heater Switch

If valve amplifying tubes are used in the transmitter section of a transceiver then the Heater Control allows you to switch off the valve heaters and so not waste electricity while you are only receiving.

MIC Socket

This is where you plug in your microphone for voice transmissions.

Key Socket

This is where you plug in your morse key for morse code transmissions.

Phone Socket

This is where you plug in your headphones for careful or quiet listening.

Other Controls

Many sockets are also normally provided on the back panel of multiband transceivers for such things as the addition of VHF, UHF and SHF transverters, provision for relaying transmissions from one frequency band to another and even for transmitting telephone calls onto the amateur bands. This is called phone patching and at present is not permitted in Australia although it is very popular with amateurs in the United States where it is legal.

VHF AND UHF TRANSCEIVER CONTROLS

As well as the normal controls contained on the HF transceiver, there are several additional controls found on some VHF-UHF sets.

Squelch or Mute Control

This control cuts out all the background noise completely so that you will not hear anything from your receiver unless someone is actually transmitting. You can sit back and relax or go through the files you've brought home from the office in complete peace and quiet (until someone starts transmitting, that is). This only works for FM mode transmissions.

High and Low Switch

This control allows you to select either high or low power. Low power takes less current from your battery so that it will last longer, whereas higher power gives you a greater transmitter range if you require it.

RPT Up or Down Switch

When operating through a repeater your transmitting frequency must be either 600 KHz above (up) or below (down) the repeater's transmitting frequency (known as its *output* frequency). The repeater receives on one frequency (its *input*) and retransmits on another frequency (its *output*).

RPT-REV Switch

Repeater reverse operation is used if a repeater is not working and you wish to contact people on that channel.

The RPT-REV Switch allows you to transmit on the repeater's transmitting frequency and listen on the repeater's receiving frequency. By doing this, you can contact people if the repeater malfunctions.

Normal or Simplex Switch

This position on a switch allows you to receive and transmit on the same frequency.

DISC and DEV Switch

The discriminator (DISC) produces a voltage that can be displayed on a meter so that you can tell at a glance whether the signal being received is exactly on frequency or not.

The deviation (DEV) switch position allows you to adjust your FM voice microphone level by using a meter.

SEPARATE RECEIVERS AND TRANSMITTERS

These can be connected together and are built with provision for automatic changeover from transmit to receive or vice-versa.

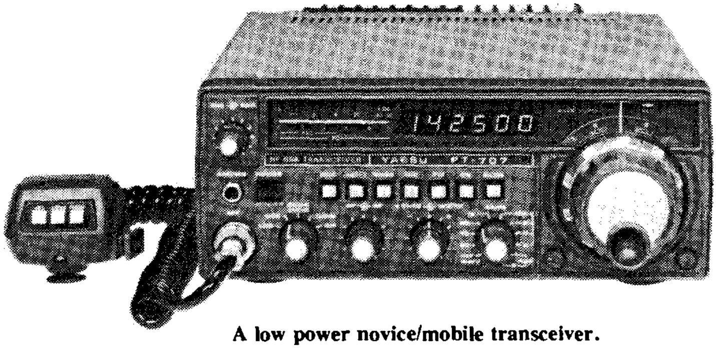
A relay is used for this purpose. The controls used here are identical to all those already mentioned. This type of setup allows you to listen on one frequency and transmit on another. Useful for cross frequency working by the use of external Variable Frequency Oscillators (VFO's).

MOBILE AND PORTABLE TRANSCEIVERS

If you want to operate from a car, boat, aircraft (all called mobile) or in a caravan, a tent, in the outback, in the country — in fact anywhere not in your home (all called portable) then you should look for a 12 volt, transistorized, small, rugged and reliable transceiver.

HF provides reliable distant coverage. The special properties of each band should be considered in relation to your particular requirements.

Chapter 7 explores the properties of each band in great detail but the following is general, basic information: for reliable around Australia night-time working, 160 and 80 metres would be the obvious choice — for around Australia daytime working it would be 40 metres — for worldwide working 20, 15 and 10 metres would be the choice. For good local coverage of 150 kilometres, say, then 6 metres and 2 metres as well as 70, 51 and perhaps 23 centimetres would be quite useful.



A low power novice/mobile transceiver.

HANDHELD PEDESTRIAN TRANSCEIVERS

Any transceiver which you can carry in your hand or put in an over-the-shoulder carrying bag is called handheld transceiver. If you want to walk to the shops talking to someone interstate, or even in Singapore, then you will need a 12 volt small transistorized transceiver. Because you must use batteries, the current consumption should be as low as possible.

Use of the morse code mode provides the smallest current drain; next is SSB, and finally the AM and FM modes.

CB-AM handhelds can be easily modified onto 10 metres and mobile transceivers can be put into over-the-shoulder carrying packs (available from disposal stores). Packs can also contain small, lightweight 12 volt rechargeable motorbike batteries available from battery dealers.

MORE INFORMATION?

Amateur Radio magazine (sent to you free each month when you join the WIA) features excellent reports on the latest in transceivers.

Other magazines such as *Electronics Australia, Electronics Today International* and *Amateur Radio Action* also carry some interesting articles.

You can, of course, visit your nearest electronics dealer and obtain leaflets with more information on the set which takes your fancy.

CONSTANTLY ASKED QUESTIONS

(Here are three important questions that I'm constantly being asked.)

Can a novice amateur buy a transceiver or linear amplifier which is capable of operating outside the novice bands and above the novice power limit?

Yes, so long as you stay within the novice band and can adjust your amplifier to within the novice power limit, you're O.K. This means that when you get your FULL licence, you don't need to buy a whole new station all over again.

Can a limited amateur buy a HF transceiver for use with transverters to get him or her onto the VHF, UHF and SHF bands?

Yes, limited licences can receive on HF and transmit on the 52 MHz band and above if they wish to work cross band. Or, you can use an HF with transverters to get up to 52 MHz and above.

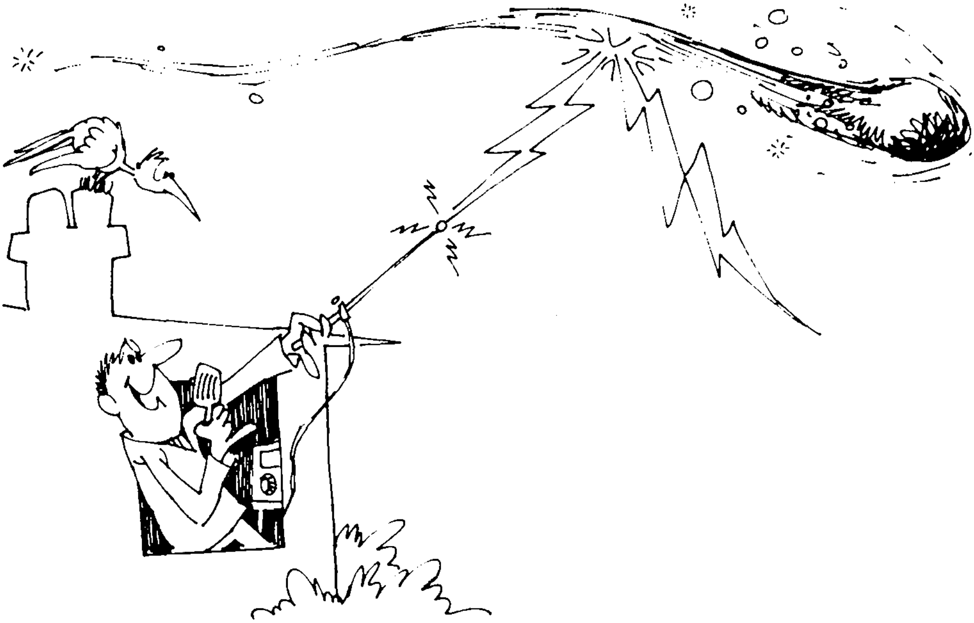
Can a full amateur buy a linear amplifier which is rated above the 400 watt limit?

Yes, as long as this limit is not exceeded, that's quite O.K. Take the 160 metre band for example where the only way of reaching 400 watts using commercially available equipment is the purchase of a 2000 watt linear designed for the use of American amateurs. All equipment for the novice, limited and full amateur licensee should contain meters which allow for easy adjustment so as not to exceed the legal power levels.

Chapter

6

Getting Started on the Airwaves



Getting Started on the Airwaves

Yes, you've finally passed that exam, set up your shack . . . and now you're ready to go . . .

But where . . . ? That's the jackpot question — you probably hadn't counted on the acute attack of goosepimples that goes with making your first transmission. So, for starters, how about switching on and listening in to what some of the others are up to . . .

Hey, that must be Simon from down the road and he's talking with . . . a bloke in Germany! That's fantastic!

Well, let's tune around a bit more and see who else is on air. Hold everything, there's Pete tapping away at the morse code key . . . where's a pen to write down what he's saying . . . "Hey Bill, it's so cold in Hobart tonight that I just had to grab the old morse key to get the blood circulating in my finger". Everyone's heard of people using morse code because they had a sore throat but *getting the blood going* — that's different!

ANYONE FOR TYPING?

That's a really weird noise . . . could it be radio teletype? Yes! There's a teletypewriter connected to the set. It would be fantastic to try that one day. You don't even have to be at home to receive messages — they're typed out on a sheet of paper as they come through and you can read them over a can of beer when you get home from work.

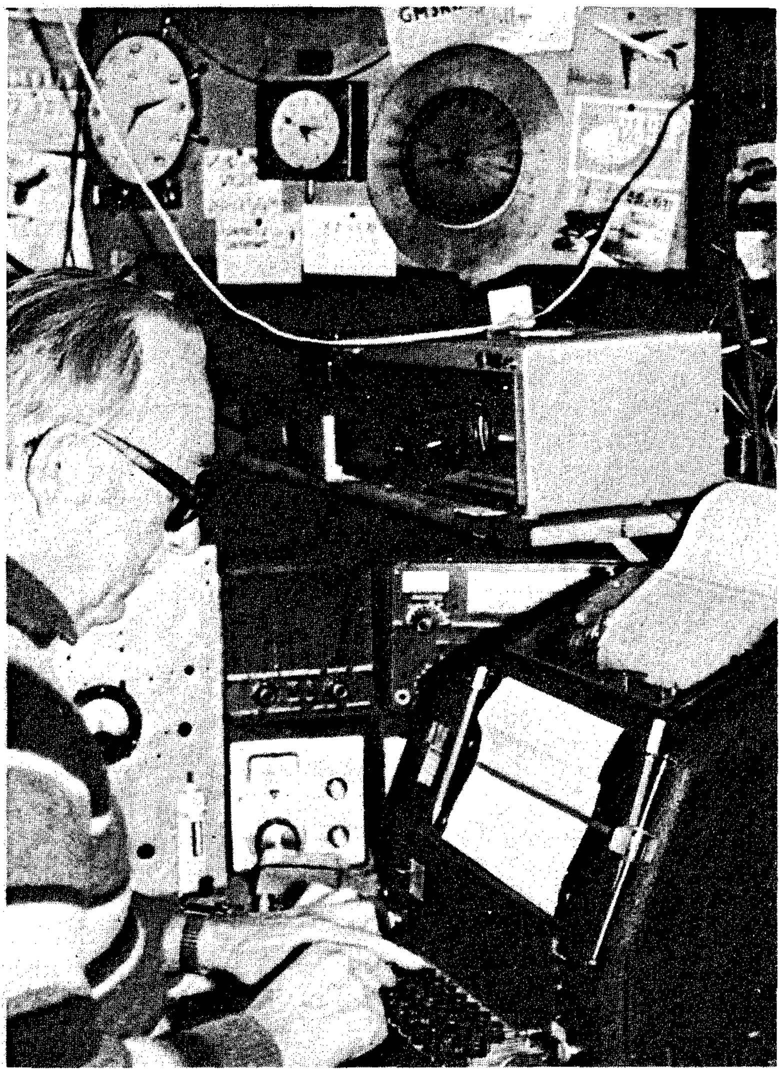
WANT TO SEE MY SLIDES?

Hold it. That's another strange noise on the air — but it's not radio teletype . . . wait a moment, it's stopped. Now someone's saying something in voice . . . "W6AA in Los Angeles, I can see your wife and kids — they look great. Now how about letting me have a look at those prize flowers in your garden. Wow! They're really something. Say that must be your Harbour Bridge — it looks like a coathanger!"

That's John down the road, he's been a full call for three months and now he's experimenting with Slow Scan Television.

DID YOU SAY SATELLITES?

What the heck's happening now? That girl said she was in New Zealand and the bloke she's talking to says he's in Hawaii — and they're both operating on VHF! You guessed it, they're communicating with the help of radio satellites.



An RTTY operator at work.

TALKING TO THE MOON?

Hello . . . (two seconds later) . . . Hello . . . that's incredible!

The man says hello and two seconds later he can hear his voice coming back. That fellow's got a beauty of an antenna and each night when there is a full moon he points his antenna at it and talks to people in America and Europe by bouncing morse code or, if his signals are strong enough, even his voice off the moon and back down to the other side of the earth.

(Maybe I'm making this sound too easy – in fact it is a most difficult

means of communication but extremely satisfying for the experienced amateur.)

It's called EME, earth-moon-earth communication, or just plain "moonbounce". (See page 140 for full details.)

SEEN ANY METEOR TRAILS LATELY?

What else do the amateurs do if the moon isn't out and the satellites are below the horizon? They bounce their voices off meteor trails, of course! These are the result of meteors entering and burning up in the earth's atmosphere. This type of transmission is called meteor scatter. (See page 142 for full details.) It's a fun way to go . . .

YOUR FIRST 'CONTACT'

(. . . Hang on now, I'm getting a bit carried away here – let's start at the beginning.) Have those goosepimples disappeared yet? After all that tuning about and listening in to other people you must be ready to make your first 'contact' — amateur jargon for an on-air conversation. So let's go.

SPECIFIC OPERATING PROCEDURES

Amateurs all over the world follow specific operating procedures which are designed to make on-air operating fun and enjoyable for everybody on the radio airways.

(Never forget that Australia's image is projected to thousands of people all over the world by the way amateurs like you and I conduct ourselves on air.)

The best way to make your first contact is by calling CQ.

CQ means, "If anyone can hear me please call me."

Before putting out a CQ call, check that the frequency you plan to use is in the voice section of the amateur band.

To make sure that no-one is actually using that particular frequency listen first before transmitting, as it would be very inconsiderate to interfere with someone else's contact.

Be certain that you're within your licenced part of the amateur band, and that you're on the correct sideband if you are using SSB. Check that you won't interfere with any adjacent stations if you intend to use AM. Now you're all set to put out your first CQ call.

LENGTH OF CQ CALLS

The length of the CQ call varies from band to band. Where your equipment can be tuned over any frequency within a given band, the CQ call may last up to a minute on a quiet band — this is to allow people to tune into your signals. On a busy band using a popular frequency, your CQ call may only have to be five seconds long to get a contact.

A CQ call normally consists of the words "Hello CQ, CQ, CQ — this is VK6AA, this is VK6AA in Perth, Western Australia". On the MF and HF bands this whole sentence could be repeated three times with the final sentence including the words, "Calling CQ and standing by."

On VHF and UHF or on any frequency where many people are continuously listening — it is more normal to simply say "CQ, this is VK6AA calling CQ and standing by."

Your reply would be "Hello VK6AA — this is VK5AA in Adelaide — you are my first contact — can you hear me — over."

WHAT TO TALK ABOUT?

On your first transmission your friend in Perth will probably give you his first name, his location, whether or not your voice is coming in clearly (see page 58 for signal strength reporting procedure) and the type of equipment and antenna being used.

The conversation would go something like this:

"VK5AA this is VK6AA. Hello there — glad to be your first contact. My name is Jim and I'm transmitting from Perth. Your signals are very good here. Readability five and Strength nine. I'm using a small homemade 10 watt transmitter to a little vertical antenna. Now back to you VK5AA. This is VK6AA over."

"VK6AA this is VK5AA. I'm really excited to be on air for the first time. I started out as a CB'er. That got me interested in radio and so I decided to become an amateur. Oh, sorry, I forgot to tell you my name — it's Tony. I'm not really quite sure what to do on air yet, so if I say something wrong please tell me. VK6AA, this is VK5AA over."

As the contact develops both parties should give additional information about themselves — occupation, hobbies and other interests.

Keep a pencil and pad handy and jot down the various points as they arise. This way you won't forget something the other operator mentioned.

Try and make your contacts interesting and diverse and this will encourage the person with whom you are talking to share his interests and ideas with you.

A spirit of fun, responsibility and understanding creates the right atmosphere on the airwaves and helps everyone to enjoy the hobby to the fullest.

ENDING A CONTACT

When you wish to conclude the contact the language used is similar to normal polite conversation. It might go like this:

"It's been nice to talk to you for the first time, Jim, I hope to work you again. All the best, VK6AA — this is VK5AA in Adelaide — clear."

GIVING SIGNAL REPORTS

In voice transmission the signal report consists of two numbers, the first tells you the readability or how much of the conversation you could understand. The second number tells you the signal strength or how strong or weak the signal is.

When you are operating on morse code a third number is included which tells you how good the quality of your morse code signals are.

THE RST SIGNAL REPORTING METHOD

Readability

1. — Unreadable
2. — Barely readable occasional words distinguishable
3. — Readable with considerable difficulty
4. — Readable with practically no difficulty
5. — Perfectly readable

Signal Strength

1. — Faint signals barely perceptible
2. — Very weak signals
3. — Weak signals
4. — Fair signals
5. — Fairly good signals
6. — Good signals
7. — Moderately strong signals
8. — Strong signals
9. — Extremely strong signals

Tone (for morse code only)

1. — Extremely rough hissing note
2. — Very rough a.c. (alternating current) note
3. — Rough a.c. tone — slightly musical
4. — Rather rough a.c. — moderately musical
5. — Musically modulated note
6. — Modulated note, slight trace of ripple
7. — Near pure tone, trace of ripple
8. — Near perfect tone, slight trace of ripple
9. — Perfect tone, no trace of ripple or modulation of any kind

The tone only refers to the purity of the signal. Add X after the tone report if the signal is very stable. Add K if the signal has clicks and any other slight frequency changes accompanying the keying. Add C if the signal has a chirpy sound.

On voice you say

"Your signals are readability . . . strength . . . "

On morse code you tap out

"Ur sigs RST . . . "

(*Ur* means 'your' — *sigs* means 'signals')

REGULAR STATION IDENTIFICATION

Your call sign is you. Make sure to give regular station identification clearly and distinctly as required by the amateur regulations. Call signs must be announced at the beginning and end of every transmission and at least once every five minutes.

(I've got to tell you – Boris broke that rule the other night. He'd just found out that his contact in the Kremlin had joined him in Siberia!)

UNIVERSAL TIME

Since you are going to be in contact with amateurs in various time zones throughout the world, a special twenty-four-hour time system is used in amateur radio. This is known as Greenwich Mean Time (GMT) or Universal Time Co-Ordinated (UTC) or Zulu (Z). When speaking on the air always use Universal Time, *never* your local time. (See page 165 for a chart listing local and corresponding Universal times.)

The two most often used time signal stations operate from Japan (called JJY) and the United States (called WWV). These stations transmit the exact time. Many transceivers have a JJY/WWV position on the band selector to which you can tune.

INTERNATIONAL PHONETIC ALPHABET

The following phonetic alphabet is used by amateurs around the world to minimise the chance of an error in voice reception. For example, you would say: "My name is Dick — Delta, India, Charlie, Kilo." But if reception is *perfectly clear*, don't overdo it — just say: "My name is Dick."

A — Alfa
B — Bravo
C — Charlie
D — Delta
E — Echo
F — Foxtrot
G — Golf
H — Hotel
I — India
J — Juliet
K — Kilo
L — Lima
M — Mike
N — November
O — Oscar
P — Papa
Q — Quebec
R — Romeo
S — Sierra
T — Tango
U — Uniform
V — Victor
W — Whisky
X — X-Ray
Y — Yankee
Z — Zulu

ROUND TABLE OPERATING

A whole group of people can all join in a conversation on one frequency. Each member of the group either speaks in turn or you could use a more flexible system where anyone can talk — just as in a conversation between a group of people in the same room.

If two people transmit at the same time on AM then it's very hard to hear because of a loud squealing interference noise called a heterodyne. However, on SSB there is no squealing noise and a third party can hear two other people talking.

Never hold up the conversation by waffling about nothing — either think of something interesting to say or quickly pass to the next operator.

BREAKING INTO A CONVERSATION

It is normal not to enter into a contact between two stations or a network unless you are particularly invited. But if you do wish to join or "break in" on a conversation, it is *not* correct to just call out "BREAK, BREAK."

The correct procedure is to wait until one station turns it over to another station and you say, "Break — this is VK8AA."

Never break in on top of another station — except in an emergency. Once you have identified yourself sit back and patiently wait until you are called into the group.

VOICE OPERATING GUIDE

- *Listen before you call CQ.*
  Don't make overly long CQ calls. Short calls with frequent breaks to listen for replies is a better operating procedure.
- *Courtesy and understanding* are contagious and create a good atmosphere on the airwaves.
- *Always give signal reports honestly* and include other essential information in the first transmission. This gets the contact going.
- *Watch the length of your transmission,* especially where there are more than two stations in the one contact.
- As you listen to a conversation have a pen and paper handy to note down the things you would like to say before you forget.
- *Make sure your voice level is constant* and that what you are saying is coming through *without distracting background noises.* Your microphone and transmitter should be adjusted to send out a clear and distinct voice.
- It is wise to *stay clear of controversial or emotional* topics which could cause heated arguments on the airwaves.
- *Use codes only when there is an advantage.* (See Q Code page 64). For example, saying, "My QTH is" has no real advantage over saying, "My location is."
- *Always go out of your way to help a newcomer* to the airwaves. (Remember the goosepimples you had before making your first contact?)

MORSE CODE OPERATING PROCEDURE

It is quite possible that what sounds like a clear frequency may actually be in use by someone whom you can't hear but who can be heard by someone near you.

The morse code equivalent of, "Is this frequency in use?" is the morse letters *IE (.. .)*.

If you don't hear anything you can send 'IE' again just to make doubly sure. If you hear 'I' (..) it means, "This frequency is not now in use — go ahead" or 'E' (.) it means, "This frequency is busy — standby or find another frequency."

On morse code you send out your CQ call at the speed which you would like the reply. In other words send slowly for a slow contact or send fast if you want a fast speed contact.

Before transmitting, you send the signal - · · · - which means "I am about to commence transmitting on this frequency."

Then in morse code, you send the rhythm of "CQ CQ CQ" followed by the letters 'de' (which means "this is") followed by your call sign two times. Next the signal · - · - · is sent which means "I have finished transmitting on this frequency". Finally the letter K (- · -) is sent which means "go ahead".

The complete morse code CQ call would be - · · · - CQ CQ CQ de VK8AA VK8AA VK8AA · - · - · K

MORSE TUNING

On voice, it is easy to tune in a voice station calling CQ. You just tune into the spot where the voice sounds the clearest.

On morse code you can tune the receiver across a morse code signal and hear different tones. Naturally, you leave the morse receiver on the clearest tone. But for transmitting, you must adjust the receiver so that the tone goes so low in pitch that you just can't hear it — this is called 'zero beat' and puts your transmitter on the same frequency as the morse code station which you are receiving.

MORSE CODE ABBREVIATIONS

To help speed up morse code contacts many words and sentences are greatly abbreviated.

Take time to listen to a few of the contacts across the morse code section of each of the amateur bands and you will soon get the idea of how to use the various abbreviations.

When giving signal reports, you simply send 'Ur sigs RST - - - ' (meaning your signals are: readability - and signal strength - and tone -)

MORSE CODE ABBREVIATIONS

AA	All after (repeat everything you sent after a certain word)
AB	All before (repeat everything you sent before a certain word).
ABT	About
AS	Wait
AMP	Ampere
BCL	Broadcast listener
BK	Break
BN	Between (or repeat all words between)
BUG	Semi automatic morse code key
C	Yes
CK	Check
CL	Closing station
CFM	Confirm (or I confirm)
CUD	Could
CUL	See you later
CW	Continuous wave (morse code signals)
DLD	Delivered
DX	Distance
ES	And
FB	Fine business, Excellent
FREQ	Frequency
GA	Go ahead, Get answer
GB	Goodbye
GBA	Give better address
GE	Good evening
GG	Going
GM	Good morning
GN	Good night, Gone
GND	Ground (or earth connection)
GUD	Good
HI	Laughter, high
HR	Here, hear
HV	Have
HW	How
LID	"LID" — a poor operator
MILS	Milliamperes
MN	Minute or Minutes (to indicate the duration of a wait)
N	No
ND	Nothing doing
NIL	Nothing
NR	Number, near

OK	Agreed
OM	Old man
OPN	Operation
OP (or OPR)	Operator
PSE	Please
RCD	Received
RCVR	Receiver
RI	Radio Inspector
RPT	Repeat
SED	Said
SEZ	Says
SIG (or SG)	Signature
SIGS	Signals
SOS	Distress sent by station in grave danger requesting immediate assistance
SKED	Schedule
TU (or TNX)	Thanks
TTT	Safety signal sent before meteorological warning regarding safety of navigation
U	You
UA	Do you agree
UR (or URS)	Your, yours
VY	Very
WD (or WDS)	Word, words
WKD	Worked
WKG	Working
WA	Word after (for requesting a repetition of a word)
WAT	What
WB	Word before (for requesting a repetition of a word)
WUD	Would
WX	Weather
XMTR	Transmitter
XXX	Urgent signal indicating message regarding safety and requesting assistance as soon as possible
YL	Young lady
XYL	Wife
73	Best regards
88	Love and kisses

Another set of abbreviations popular on the morse code frequencies is the

INTERNATIONAL 'Q' CODE.

Abbreviation	Question	Answer or Advice
QAP	Shall I listen for you (or for . . .) On KHz?	Listen for . . . on . ... KHz
QIF	What frequency is . . . using?	He is using . . . KHz
QLM		I am tuning for replies from my frequency downwards.
QMH		I am tuning for replies from the middle of the band towards the high end
QML		I am tuning for replies from the middle of the band towards the low end.
QMU		I am tuning for replies from my frequency upwards.
QRB	How far are you from my station?	The approx. distance between our station is . . .
QRD	Where are you bound and where are you from?	I am bound for . . . from . . .
QRE	What is your estimated time of arrival at . . . place?	My E.T.A. is . . .
QRG	Will you tell me my exact frequency (or that of . . .)?	Your exact frequency (or that of . . .) is . . .
QRH	Does my frequency vary?	Your frequency varies . . .
QRT	How is the tone of my signals?	Your tone is — 1. GOOD, 2. VARIABLE 3. BAD
QRK	What is the readability of my signals	Your readability is (1 to 5) as in the RST
QRL	Are you busy?	I am busy (or I am busy with) — please do not interfere
QRM	Is my signal being interfered with?	Your signal is being interfered with 1. NIL, 2. SLIGHT, 3. MODERATE 4. SEVERELY, 5. EXTREME
QRN	Are you being troubled by static?	I am troubled by static (1 to 5 as above)
QRO	Shall I increase my power?	Increase power

QRP	Shall I decrease my power?	Decrease power
QRQ	Shall I send faster?	Send faster (. . . words per min.)
QRS	Shall I send slower?	Send more slowly
QRT	Shall I stop sending?	Stop sending
QRU	Have you anything for me?	I have nothing for you
QRV	Are you ready?	I am ready
QRW	Shall I inform . . . that you are calling him or her on . . . KHz	Please inform . . . that I am calling him or her on . . . KHz
QRX	When will you call me again?	I will call you again at . . . hours on . . . KHz
QRY	In a round table you ask "What is my turn"	Your turn is number . . .
QRZ	Who is calling me?	You are being called by . . . on . . . KHz
QSA	What is the strength of my signals or those of . . .	The strength of your signals or those of . . . is 1. SCARCELY PERCEPTIBLE, 2. WEAK, 3. FAIR, 4. GOOD, 5. VERY GOOD
QSB	Are my signals fading?	Your signals are fading
QSH	Are you able to home in on your direction transmission?	I am able to home in on my D.F. equipment on station . . .
QSI	I have been unable to break in on your transmission	Will you inform . . . that I have been unable to break in on his transmission.
QSL	Can you acknowledge receipt?	I am acknowledging receipt.
QSN	Did you hear me (or . . .) on . . . KHz	I heard you (or . . .)
QSM	Shall I send the last message I sent you or some previous message	Repeat the last message
QSO	Can you communicate with . . . direct or by relay	I can communicate with . . . direct or by relay
QSP	Will you relay to . . . ?	I will relay to.

QSS	What working frequency will you use?	I will use the working frequency . . . KHz
QST		Calling all radio amateurs.
QSU	Shall I send or reply on this frequency (or on . . . KHz)?	Send or reply on . . . KHz
QSV	Shall I send a series of V's on this frequency?	Send a series of V's on this frequency.
QSW	Will you send on this frequency (or on . . . KHz)	Send on this frequency or on . . . KHz
QSX	Will you listen to . . . on . . . KHz?	I am listening to . . . on . . . KHz
QSY	Shall I change to another frequency?	Change to another frequency (or to . . . KHz)
QSZ	Shall I send each word or group more than once?	Send each word or group twice (or . . . times)
QTH	What is your location?	My location is . . .
QTR	What is the correct time?	The correct time is . . .
QTU	What are the hours which you are operating?	The hours which I am on the air are . . .
QTV	Shall I stand guard for you on the frequency of . . . KHz?	Stand guard for me on the frequency of . . . KHz
QTX	Will you keep your station open for further communications with me until further notice (or until . . . hrs)?	I will keep my station open.
QTY	Are you proceeding to the position of incident and if so when do you expect to arrive?	I am proceeding to the position of the incident and expect to arrive at . . . (on . . . date).
QTZ	Are you continuing the search?	I am continuing the search for . . . (survivors, wreckage, etc.)
QUA	Have you news of . . . ?	Here is news of . . .
QUF	Have you received the distress signal I sent by . . . ?	I have received the distress signal sent by . . . at . . . hrs.
QUM	May I resume normal working?	Normal working may be resumed.

FIRST TRANSMISSION

Your first Morse transmission may be something like this. “ - · - · - VK3AA de VK7AA Hi my name is John, John QTH Hobart ur rst 599 rig is a homemade 1 watt set. ant is a dipole. Hw copy? VK3AA deVK7AA . - · - · - · -”

Some new abbreviations here are *rig* which means “my transceiver”, and *ant* which is “my antenna” and *Hw copy* means “How did you copy me”. Just by looking at what you have written down you will often be able to see what a new abbreviation means.

THE MORSE CODE CONTACT

At the end of each morse code “over” normally the letter K is sent, meaning “go ahead”. If you only want the station you have contacted to go ahead and no other stations you send $\overline{\text{KN}}$ instead of K.

The bar over $\overline{\text{KN}}$ means that when you send this over morse code you run the K and the N together and not separately.

ENDING A MORSE CODE CONTACT

Your final morse code contact could be something like this:

“ - · - · - VK1AA de VK9AA TNX for the nice QSO CU AGN 73 $\overline{\text{SK}}$ VK1AA de VK9AA CL.

In words this means — I AM ABOUT TO TRANSMIT ON THIS FREQUENCY (- · - · -) VK1AA THIS IS (de) VK9AA THANK YOU (TU) FOR THE NICE CONTACT (QSO) SEE YOU (CU) AGAIN (AGN) BEST WISHES (73) THIS IS MY FINAL TRANSMISSION, THE END OF OUR CONTACT ($\overline{\text{SK}}$) VK1AA THIS IS (de) VK9AA GOING OFF THE AIR (CL).

MORSE OPERATING GUIDE

- *Take your time to send clear morse,* evenly spaced between letters and words.
- *The quality of your morse sending is a direct reflection of you.* Good Morse sent slowly is far, far better than incorrect Morse sent fast.
- *Always be helpful to the newcomer* who is having his or her first few contacts on the morse key. (I'll say it again — remember how you felt?) Be helpful, courteous and understanding.

MORSE CODE BREAK-IN OPERATION

Break-in operating is a technique similar to VOX operation on voice. Break-in operating allows you to receive between the dots and dashes which you are sending out. This means that you can hear everything that is happening on your frequency.

If your signal is fading out or there is interference, then other stations can easily ask you to stop transmitting and repeat whatever they missed out. It's quite an enjoyable way of operating morse.

You can call CQ using break-in. For example, - · - · - CQ CQ CQ de VK4AA VK4AA BK (pause), if no reply continue CQ CQ CQ de VK4AA VK4AA BK (pause) and so on.

BK means you are using break-in operation and you're listening for any reply. Because you use break-in operating, someone could even break-in during your CQ calling and you would hear them.

BREAKING INTO A CONVERSATION

Normally you do not interfere with a two-way contact either on voice or morse. If you only want one of the persons to whom you are listening then you wait until the person you want signs off with the station to whom he or she is talking. If you wish to break into a conversation you wait until one station turns it over to the other station and you say, "BK de VK2AA".

SIMILARITIES BETWEEN VOICE AND MORSE PROCEDURES

VOICE	MORSE CODE	MEANING
OVER	$\overline{\text{AR}}$	You use this when you are calling a specific station e.g. "VK1AA de VK2AA $\overline{\text{AR}}$."
END OF MESSAGE	$\overline{\text{AR}}$	This is used to mark the end of a message.
STANDBY (WAIT)	$\overline{\text{AS}}$	Useful if you need to answer the door or telephone
BREAK	BK	Break is always followed by your call sign, e.g. 'Break this is VK7AA'. Break means please let me use this frequency to pass a message.
CLOSING STATION	CL	I am closing my station, e.g. VK2AA de VK6AA CL.

GO	K	Any station can call me — commonly used after a CQ call.
GO ONLY	$\overline{\text{KN}}$	Only the station I am calling go ahead please.
ROGER	R	Does NOT mean yes, O.K. or I agree. It only means "I have *received* what you have transmitted.
CLEAR	$\overline{\text{SK}}$	I am ready to be called by any station other than the one I have just worked. e.g. "73 es gud DX $\overline{\text{SK}}$ VK2AA de VK1AA." ($\overline{\text{AR}}$ is not normally included).

R as well as meaning "I have received everything perfectly" can be used as a colon when sending the time, e.g. 2.20pm is sent as 2R20 pm. It can also be used as a decimal point, e.g. 3.5MHz is sent as 3R5MHz.

$\overline{\text{BT}}$ is used to separate thoughts during a conversation, e.g. "VK7AA de VK0AA GE OM TNX CALL $\overline{\text{BT}}$ UR 359 IN ANTARCTICA $\overline{\text{BT}}$ Name Sam $\overline{\text{BT}}$ WAT U DOING UP SO LATE".

$\overline{\text{IMI}}$ — this is used as a question mark. For example, name $\overline{\text{IMI}}$ means repeat your name. If you had some problem, you could ask for a second repeat simply by sending $\overline{\text{IMI}}$.

$\overline{\text{IMI}}$ can also be used to indicate that you are about to repeat a word, e.g. "QTH Wellington $\overline{\text{IMI}}$ Wellington".

If a question is asked such as "CAN U QSY AM $\overline{\text{IMI}}$ (meaning "Can you change to AM voice operating?) then your answer would be "Yes" if you sent a "C". If you only sent R then it would only mean "I have received your message."

DX-ING PROCEDURES

At this stage you already know that DX-ing is basically long distance transmitting. But there are some subtleties about DX procedures which any well informed amateur should know.

- On bands such as 1.8, 3.5, 7, 14, 21 and 28 MHz, DX normally means any station outside of Australia; whereas on the bands from 52 MHz through to 24,000 MHz contacts of roughly in excess of 250 km are regarded as DX.
- If a CQ DX call is made by an Australian amateur between 1.8 to 29.7 MHz it means, "If anyone outside of Australia can hear me, please reply." (So, *don't respond if you are in Australia.*)

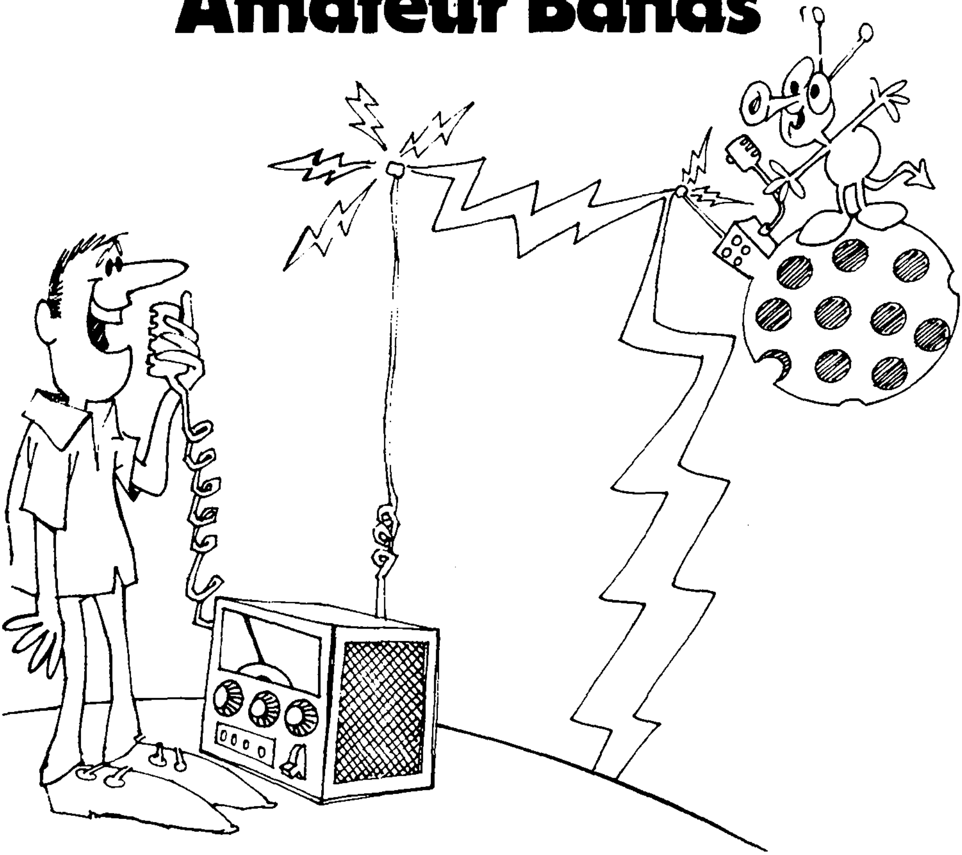
- If you pick up a CQ DX call on any frequency between 52 MHz to 24,000 MHz, it means, "If anyone more than about 250 kilometres from me can hear this call, please reply."
- If you hear a CQ DX call from someone in another country — move in fast.

(. . . Ah well, let's face it, there's a lot to learn about correct operating procedure . . . and this chapter contains only the basic info. I'll delve deeper into the mysteries of on air procedures and "etiquette" in Chapter 12.)

Chapter

1

How to Use the Different Amateur Bands



How to Use the Different Amateur Bands

Remember the sixteen amateur bands which are spread out across the radio spectrum? Well, let's take a closer look at each band and see what goes on inside them. But before we do, let's have a look at the way radio waves travel over such long distances.

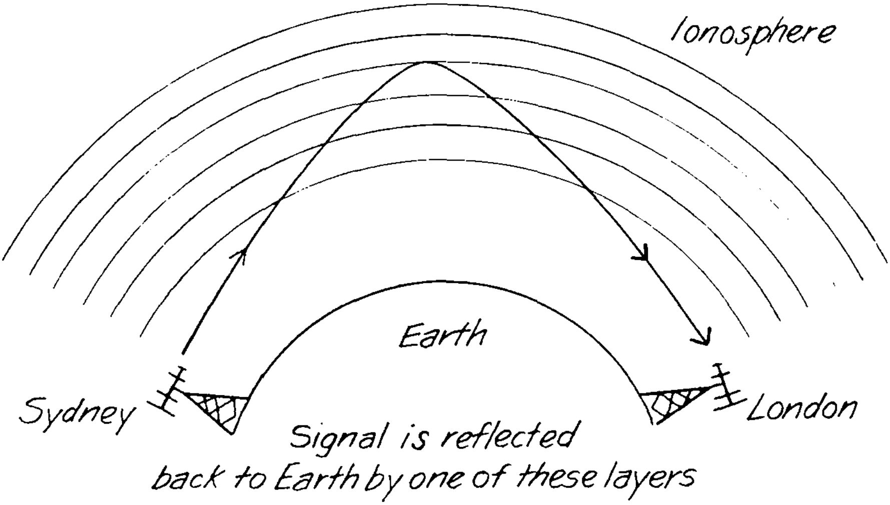
RADIO WAVES

There are basically two different types of radio wave.

- Ground wave — the radio signal travels over the earth's surface following its curve. (The low frequency bands have predominately ground wave content.)
- Skywave — the radio signal initially travels upwards and the distance it is transmitted depends on the frequency band used (the higher bands have most skywave content) and the conditions in the ionosphere.

THE IONOSPHERE

Way above the earth's surface (between 100 and 350 km) electrically charged particles called ions are concentrated in sufficiently large numbers to affect the direction of radio waves. This area is known as the ionosphere. It



is not really a single region but is actually a series of layers at various heights and of various densities. Without the reflecting qualities of the ionosphere skywave signals would be lost in space.

The layers act like a mirror and reflect, or bend, the radio waves being transmitted back down to be received in another part of the world. This is why it is possible to talk to people thousands of miles away.

TRANSMITTING THROUGH THE IONOSPHERE

If you want to transmit through the ionosphere so that you can bounce a signal off the moon, off a meteor trail or talk through a satellite in space (or with amateurs on a space shuttle?) you would have to use the very high, ultra high or super high frequency bands, as these are reflected least.

THE 11 YEAR SUNSPOT CYCLE

Sunspot activities also have a marked effect on the way radio waves travel.

Over periods of 11 years there is an increase and decrease in the numbers of sunspots on the sun's surface. For the first five and a half years the number of sunspots increases to a maximum and over the next five and a half years the number of sunspots drops to a minimum.

The current sunspot cycle peaks in 1982.

This 11 year sunspot cycle greatly affects the use of the different radio frequencies because of the changing amount of energy which escapes from the sun.

In periods of maximum sunspots, the higher frequencies are very popular whereas in periods of minimum sunspots the lower frequencies are the popular ones.

Of course, it's just like the weather forecast for summer or winter — you can experience fantastic variations from day to day.

RADIO CONDITIONS

The following magazines (WIA's *Amateur Radio*, *Electronics Australia*, *Electronics International* & *Amateur Radio Action*) carry monthly reports on radio conditions on the various bands, affecting communications between Australia and different parts of the world. This information is also given weekly on the WIA Sunday broadcast. (The times and frequencies of this broadcast are listed later in this chapter.)

MEDIUM FREQUENCY (MF) AMATEUR BANDS

The 160 metre band — 1.800 to 1.860 MHz

The one hundred and sixty metre band is the smallest frequency allocation available to amateurs in this country. (This band is very close to the Broadcasting Band).

Occupying only a small portion of the radio spectrum, it represents the historical remnants of a once wide range of frequencies which were used by Marconi and other early amateurs.

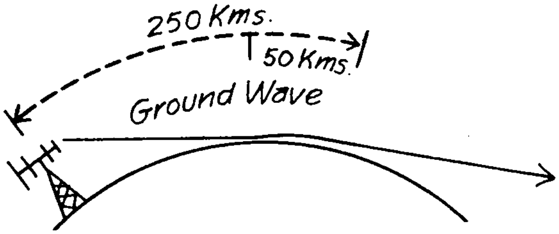
160 metres is fondly known around the world as "Top Band" and you may find its enthusiasts out in the park on a sunny afternoon flying a 38 metre long wire vertical antenna at the end of a kite.

160m is the only medium frequency band available to amateurs.

WHERE THE ACTION IS ON 160 METRES

Frequency (MHz)	Type of Activity
1.800 to 1.810	Morse code section
1.810	Voice section
1.825	Australian calling and listening channel
1.820	Also a popular channel

The 160 metre band provides the longest ground coverage available to the amateur. The 160 metre waves follow the earth's curvature for about 250km until they tend to lift off the ground.



160 metres provides excellent "ground wave" coverage. Because of the ground wave coverage, 160 metres has proved to be a useful mobile band especially for reliable day time coverage. During night time hours a coverage of several thousand miles can be obtained.

Under certain ionospheric conditions, especially when sunspot numbers are low, 160 metres is the only amateur band which will support communications with other parts of Australia, particularly within one's own state.

For you troglodyte amateurs keen on cave exploring, reliable communication has always been a problem — the 160 metre band gives the best possible results.

FREQUENCIES USED ON 160 METRES OVERSEAS

America and the United Kingdom	1.8 to 2 MHz
New Zealand	1.803 to 1.813 MHz and 1.875 to 1.900 MHz
Japan	1.9075 to 1.9125 MHz

Around the world most of the amateur frequencies are identical, allowing you to talk with amateurs all over our planet. However, as you can see from the above, there can be some frequencies used overseas which are outside the Australian amateur band.

To talk with amateurs under such a situation, a type of operation called "cross frequency working" is popular. For example, if you wanted to contact Japan on 160 metres, you would listen on the Japanese portion of the 160 metre band and you would call hoping that someone in Japan was listening on the Australian portion of the 160m band.

Talking to people in the United States and South America is best just after sunset, into Asia around midnight, into the Middle East and Africa an hour or two before sunrise and into Europe just before sunrise.

Morse Code and lower sideband are popular for long distance working.

Homemade (homebrew) AM transmitters are also quite popular for mobile and home operation. Many people listen into the amateurs on ordinary radio sets that have been modified to pick up 160 metres just above the commercial radio stations.

AMATEUR RADIO NEWS BROADCASTS from the Wireless Institute of Australia can be heard each Sunday on 160 metres

Frequency (MHz)	Coverage Area	Local time
1.8125	NEWCASTLE	11am
1.820	ADELAIDE	9am
1.825	SYDNEY	11am
1.825	N.S.W.	7.30pm
1.825	BRISBANE	9am
1.840	MELBOURNE	10.30am

To be able to transmit on 160 metres, you must hold a Full Amateur Licence.

HIGH FREQUENCY (HF) AMATEUR BANDS

The 80 metre band — 3.5 to 3.7 MHz

The 80 metre band gives you reliable coverage of Australia and New Zealand during the night time hours.

You can build up your first one valve transmitter on this band for a few dollars and even though only a section of 80 metres can be used with the novice licene, it is one of the most popular novice bands.

Like 160 metres, world-wide contacts are possible at night time. Ground wave distance is usually about 150km, although at low periods of sunspot numbers a daytime coverage of 300km is possible due to ionospheric reflection.

WHERE THE ACTION IS ON 80 METRES

Frequency (MHz)	Type of Activity
3.500 to 3.535	Morse code section
3.535 to 3.700	Voice section
3.525 to 3.575	The Australian, New Zealand and New Guinea novice 80m section
3.525 to 3.535	Novice morse code section
3.535 to 3.625	Novice voice section
3.535	Popular novice morse channel
3.545	Popular novice voice channel
3.555	Popular novice voice channel
3.565	Popular novice listening channel
3.575	Wireless Institute Civil Emergency — morse code working frequency
3.600	Wireless Institute Civil Emergency — Primary calling and listening channel
3.620	Worldwide radio teletype channel
3.625	Wireless Institute Civil Emergency — voice working frequency

FREQUENCIES USED ON 80 METRES OVERSEAS

3.5	to	3.9 MHz	New Zealand 80 metre band
3.5	to	4.0 MHz	American 80 metre band
3.7	to	3.75	American novice stations (morse code only)
3.5	to	3.775	American 80m morse only segment
3.775	to	4.000 MHz	American 80m voice segment
3.735	MHz		International Slow Scan Television channel

As on 160m, if you hear something interesting outside the Australian amateur band, you can make contact by *cross frequency* (cross band) operation. This is often used to contact the Americans who are only allowed to use voice above 3.775 MHz.

If you hold a novice licence, you can also get into cross frequency operation where, for example, you could talk to a fully licenced amateur by listening to him on 160 metres and he could talk back to you by listening on 80 metres. Because both transmitters can stay on at the same time, it's just like having a telephone conversation!

AM and lower sideband voice and morse code transmissions are popular.

People all over Australia listen into the regular slow **MORSE CODE PRACTICE SESSIONS** broadcast by the Wireless Institute of Australia on 80 metres.

Frequency (MHz)	Coverage area	Local time
3.550	N.S.W.	7.30pm daily
3.550	South Aust.	8.00pm daily
3.550	West. Aust.	8.00pm Mon to Fri
3.555	North. Terr.	7.30pm almost daily
3.580	Queensland	7.30pm Tues/Wed/Thurs
3.595	Newcastle	7.30pm Mon

These morse code practice sessions can normally be received all over Australia and you can use it to prepare for the amateur morse code exam if you have an 80 metre receiver.

AMATEUR RADIO NEWS BROADCASTS from the Wireless Institute of Australia can be heard each Sunday on 80 metres

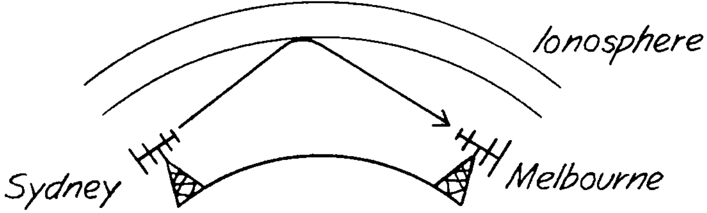
Frequency (MHz)	Coverage Area	Local time
3.545	N.S.W.	7.30pm Radio Teletype Broadcast
3.550	South Australia	9.00am
3.555	Northern Territory	7.30pm
3.570	Canberra	7.30pm
3.570	N.S.W. (Mondays)	7.30am
3.560	Western Australia	9.30am
3.580	Queensland	9.00am
3.595	N.S.W.	11.00am
3.595	N.S.W.	7.30pm
3.595	Newcastle	Monday 7.30am
3.600	Victoria	10.30am

As a novice operator you will find 80 metres gives you fairly reliable round Australia coverage during the night hours. 80 is also a popular band for talking to people within your state or in adjacent states while you're travelling in a car.

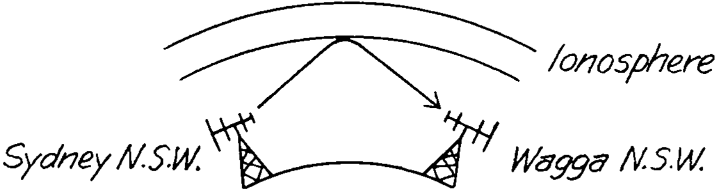
Whereas the main communication problems on 160 metres are the high thunderstorm noise levels which occur in summer, the 80 metre band suffers from both the high noise levels of thunderstorm activity hundreds of kilometres away and the interference caused by commercial transmitting stations in the evening hours.

The 40 metre band — 7.0 to 7.150 MHz

On this band reliable round Australia coverage is possible during the daylight hours. If solar or sunspot numbers are low during the daytime then people in adjacent states can be worked.



If, however, sunspot numbers are high during the daytime only comparatively local contacts can be made.



During the late afternoon, night, and early morning hours, you can get world wide coverage using morse code and lower sideband on 40 metres.

Around Australia, mobile operating as well as home-made AM equipment can be found.

On 40 metres, the main interference problem is from commercial broadcasting stations operating outside their authorised bands during late afternoon and night time.

WHERE THE ACTION IS ON 40 METRES

Frequency (MHz)	Type of activity
7.0 to 7.030	Morse code section
7.030 to 7.150	Voice section
7.025	WIA Civil Emergency network morse code working channel
7.040	International slow scan television and radio teletype channel
7.050	WIA Civil Emergency network primary calling and listening channel
7.075	WIA Civil Emergency network voice working channel

FREQUENCIES USED ON 40 METRES OVERSEAS

7.0 to 7.3 MHz	The American 40 metre band
7.0 to 7.15 MHz	American morse code section
7.15 to 7.3 MHz	American voice section
7.100 to 7.150 MHz	American novice band (morse code only)

Again on 40m there is much opportunity for cross frequency working and this is very popular. *Cross mode* operating is very popular also. Here, Australian amateurs operate with voice in the American 40 metre novice band and the American novices reply in morse code.

AMATEUR RADIO NEWS BROADCASTS from the Wireless Institute of Australia can be heard each Sunday on 40 metres

Frequency (MHz)	Coverage area	Local time
7.045	N.S.W.	10.30 am Radio Teletype Broadcast
7.075	West. Aust.	9.30 am
7.095	South Aust.	9.00 am
7.130	Tasmania	9.30 am
7.135	Victoria	10.30 am
7.146	N.S.W.	11.00 am
7.146	Queensland	9.00 am

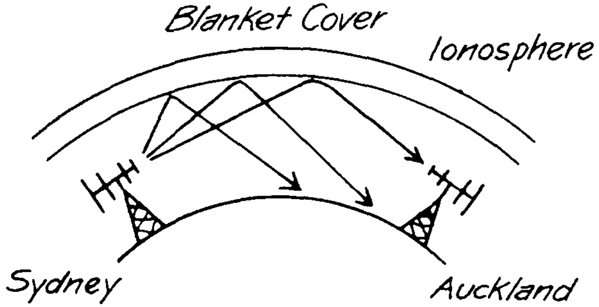
To transmit on 40 metres you must have a Full Amateur Licence. The 40 metre band is the only amateur band to be covered on the ordinary 6 to 12 MHz popular portable short wave receivers.

The 20 metre band — 14.0 to 14.35 MHz

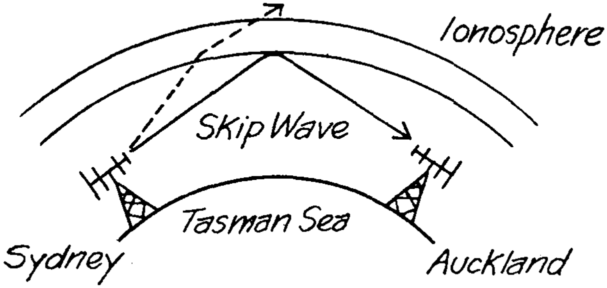
This is one of the most popular and heavily used amateur bands. It provides almost continuous world wide coverage in both daylight and night time hours during periods of high solar activity.

Whereas 160 and 80 metres usually provide a "blanket coverage", on the 40 and 20 metre bands a "skip zone" usually exists. Let's explain . . .

On 160 and 80 metres, signals are falling from the ionosphere over a whole range of angles providing a signal for anyone between say, Sydney and Auckland, to listen in on. This is called a blanket type of coverage.



On 40 and 20 metres, only one small angle of radio waves may be reflected off the ionosphere so that the signal "skips" over the Tasman sea. This means that anyone listening in the area between Sydney and Auckland would not hear anything since the signal is "skipping" over him. The area which is "skipped" over is called the "skipzone".



WHERE THE ACTION IS ON 20 METRES

Frequency (MHz)	Type of Activity
14.0 to 14.1	Morse code section
14.1 to 14.350	Voice section
14.075	WIA Civil Emergency network morse code working channel
14.090	International radio teletype channel
14.100	WIA Civil Emergency network Primary calling and listening channel
14.125	WIA Civil Emergency network Voice working channel
14.230	International slow scan television channel
14.1 to 14.2	Particularly popular with the Europeans
14.2 to 14.350	Particularly popular with the Americans

Morse code and upper sideband is used on 20 metres. International communications between mobile stations is particularly enjoyed by the 20 metre enthusiast.

AMATEUR RADIO NEWS BROADCASTS from the Wireless Institute of Australia can be heard each Sunday on 20 metres

Frequency (MHz)	Coverage Area	Local time
14.090	N.S.W.	10.30 am Radio Teletype Broadcast
14.100	West. Aust.	9.30 am
14.175	South Aust.	9.00 am
14.175	West. Aust.	9.30 am
14.342	Queensland	9.00 am

To transmit on 20 metres you must have a Full Amateur Licence.

The 15 metre band — 21.0 to 21.450 MHz

Even though only part of the 15m band can be used by the novice, this is one of the most popular novice bands for world wide transmitting.

It is also especially useful in contacting the United States and Europe at times when these areas cannot be reached on 20 metres.

The good old 15 metre band is often inconsistent for talking over long distances during the low sunspot activity periods but becomes more reliable at high solar periods. The variability of this band makes it very popular for DX use.

During mid-winter and mid-summer the 15 metre and 20 metre bands allow reception of various parts of Australia which are normally "skipped" over.

WHERE THE ACTION IS ON 15 METRES

Frequency (MHz)	Type of Activity
21.0 to 21.150	Morse code section
21.150 to 21.450	Voice section
21.125 to 21.200	Novice amateur 15m section in Australia and New Guinea
21.125 to 21.150	Australian novice morse code section
21.150 to 21.200	Australian novice voice section
21.250 to 21.450	American voice section
21.000 to 21.250	American morse section
21.090	International Radio Teletype channel
21.340	International Slow Scan Television channel

On this band cross mode working between American and Australian novices is popular. The American novices transmit on morse code and the Australian novices transmit back to them on voice. Novice amateurs find that conversing with Europeans is quite an exciting aspect of 15 metre operating.

AMATEUR RADIO NEWS BROADCASTS from the Wireless Institute of Australia can be heard each Sunday on 15 metres.

Frequency (MHz)	Coverage Area	Local Time
21.175	Queensland	9.00 am
21.160	South Australia	9.00 am

Operating on very low power is quite popular on this band. The Japanese use low power 24 channel mobile transceivers on this band between 21.210 to 21.440 MHz with channels spaced 10 kilohertz apart. Australian novices especially enjoy talking to people around the world as they zoom about in their vehicles using little 15 metre radio transmitters with less than 5 watt power.

The 10 metre band — 28.0 to 29.7 MHz

This is the third novice band and has proved very popular for worldwide as well as local communication. Mobile operating has become particularly popular with the introduction of a twenty-three channel system onto 10 metres.

It is an ideal band for very low power — long range communicating especially at the times of high sunspot numbers. During these times, the world goes crazy on 10 metres and many people claim to be using "wet strings" as their only antennas.

During periods of low sunspot activity, this band offers tremendous surprise long distance reception at times when they are least expected.

Like 15 metres, the variability and unexpected occurrences on 10 metres add that challenge and fascination that breeds the dedicated 10 metre operator.

WHERE THE ACTION IS ON 10 METRES

Frequencies (in MHz)	Type of Activity
28.0 to 28.100	International morse segment
28.0 to 28.200	Morse code section
28.1 to 28.200	American novice 10m band (morse only)
28.200 to 28.250	24 Hour amateur beacons
28.25 to 29.700	Voice section
28.1 to 28.600	Novice 10m section in Australia and New Guinea
28.1 to 28.200	Novice morse code section
28.2 to 28.600	Novice voice section
28.400	Wireless Institute Civil Emergency calling and listening 10 metre channel
28.500	Popular calling frequency
28.5 to 28.650	International voice segment
28.550	Popular local and international channel
28.7 to 29.300	Many AM channels exist in the US
28.800	Popular American AM calling channel
28.885	6 metre DX group
29.3 to 29.4	Planned Russian amateur satellite band
29.402	The radio beacon aboard the satellite OSCAR 8
29.502	The radio beacon aboard the satellite OSCAR 7
29.4 to 29.5	American Amateur satellite band
29.5 to 29.7 MHz	American 10 metre repeater band
29.6 MHz	National American voice (FM) calling frequency

In America FM transmitting is popular above 29.0 MHz.

23 CHANNEL SYSTEM WITHIN THE 10 METRE NOVICE BAND

To assist in converting the inexpensive 11 metre — 23 channel CB transceivers onto the 10 metre amateur band, amateurs around Australia have adopted the following system.

Channel number	Frequency (in MHz)
1	28.300
2	28.310
3	28.320
4	28.340
5	28.350
6	28.360
7	28.370
8	28.390
9	28.400
10	28.410
11	28.420
12	28.440
13	28.450
14	28.460
15	28.470
16	28.490
17	28.500
18	28.510
19	28.520
20	28.540
21	28.550
22	28.560
22a	28.570
23	28.590

Overseas stations normally operate above channel 17. Local and distant communication within Australia is found below channel 17. Both upper sideband and AM transmissions are used.

FREQUENCIES USED ON 10 METRES OVERSEAS

28.2 to 28.25 MHz is the *International 10 metre Amateur Radio Beacon Band.* (If you have to refresh your memory about beacons turn back to page 38.)

The beacons identify with their call signs transmitted in morse code every thirty seconds. When they are not identifying, they transmit a continuous signal on their frequency.

Some of the listed beacons, such as the Australian ones, are planned, others are currently operating in the region 28.150 to 28.195 MHz and will be changing to the above new frequencies. Just think of hearing all those — whoow!! The Americans operate many repeater booster stations in the 10m band. These repeaters will re-transmit low power mobile signals over a long distance. They can even be heard in Australia! Some are called linear repeaters and these will accept a multitude of transmissions such as morse code, AM and upper sideband and re-transmit these over a wide area.

10 METRE 24 HOUR AMATEUR RADIO BEACONS

Location of Beacon	Call sign	Frequency (MHz)
WEST GERMANY	DL0IGI	28.205
FLORIDA, USA	N4RD	28.2075
MAURITIUS, INDIAN OCEAN	3B8MS	28.210
GOUGH ISLAND	ZD9GI	28.2125
ENGLAND	GB3SX	28.215
NSW, AUSTRALIA	VK2WI	28.2175
CYPRUS	5B4CY	28.220
CANADA	VE3TEN	28.225
FRANCE	F3THF	28.2275
NEW ZEALAND	ZL2MHF	28.230
BERMUDA	VP9BA	28.235
BRAZIL	PY1CK	28.240
BAHRAIN	Z9XC	28.245
SPAIN	EA2OIZ	28.2475
NORTH EAST USA	WA1IOB	28.250
HONG KONG	VS6HK	28.290

Other repeaters only accept one mode of transmission such as FM or AM or upper sideband. So it doesn't matter if you are in the bottom of a hill or on the top of a mountain — thanks to the repeater, everyone can be heard equally well. Over fifty repeaters operate on 10 metres across the United States. There is growing use of narrow band FM interest in Australia, with quite a few overseas FM contacts being made using fairly low power rigs.

10 METRE REPEATER FREQUENCIES IN THE USA

	Transmit to the repeater on: (MHz)	Listen to the repeater on: (MHz)
REPEATER CHANNEL 1	29.520	29.620
REPEATER CHANNEL 2	29.540	29.640
REPEATER CHANNEL 3	29.560	29.660
REPEATER CHANNEL 4	29.580	29.680

(Currently there are no 10 metre repeaters in Australia)

SPORADIC E SKIP

During mid winter and especially mid summer you can talk to people around Australia and the Pacific Islands during any part of the sunspot cycle — low or high.

This strange but regular yearly occurrence is called "Sporadic E Skip". It allows unpredictable, very low power, radio transmissions to be received very clearly one moment in Fiji, the next in New Zealand and then in Broken Hill. ***(I'm never quite sure where my radio waves will land next!)***

AMATEUR RADIO NEWS BROADCASTS from the Wireless Institute of Australia can be heard on 10 metres

Frequency (MHz)	Coverage Area	Local Time
28.320	Sydney	11 am & 7.30 pm Sun
28.400	Queensland	9.00 am Sun
28.470	Taree	7.30 pm Mon
28.470	Perth	9.30 am Sun
28.500	Adelaide	9.00 am Sun

SUMMARY OF MF AND HF BANDS

Summarising the use of the bands so far, it is the 160, 80 and 40 metre bands which provide exceptional radio coverage during periods of low sunspot activity . . . whereas it's the 20, 15 and 10 metre bands which are the exceptionally good performers during the periods when there is a lot of sunspot activity on the sun's surface.

If only one of these bands becomes your favourite you might end up cursing half of the 11 year sunspot cycle, but if you come to enjoy all the bands then each day will bring a variety of challenges as you explore the radio spectrum.

Many people, of course, enjoy the bands which are expected to do worse during certain periods of the sunspot cycle because these bands offer their own challenges and surprises to the dedicated operator.

VERY HIGH FREQUENCY (VHF) AMATEUR BANDS

You must have a Full or Limited amateur licence to operate on VHF bands.

The 6 metre band — 52 to 54 MHz

This is the first of the VHF amateur bands. You will find it is particularly good for reliable local communications.

It is an excellent mobile band normally giving a reliable range of 100 to 160 kilometres.

During mid-summer and mid-winter a range of between 600 and 4000km is possible in unusual conditions using fairly low power.

As on the 10 metre band many 24 hour beacons exist on 6 metres to assist in determining what parts of the world may be within range of the 6 metre enthusiast.

During the high part of the sunspot cycle, extremely long range communications are possible. The Australian distance record on the band is 13.545 kilometres for a spectacular contact between an amateur in Victoria and an amateur in Mexico, Central America.

Record breaking contacts into Canada, California, Japan and the Soviet Union have been established by Australian amateurs on 6 metres. Currently, with the increasing sunspot activity scheduled to peak in 1982, amateurs throughout the world are getting their gear ready for this band.

(Which reminds me of the continuing story of Boris. Here's the latest from Siberia. He's just made contact with Washington! New American satellites? Da, da, da. Want to bet?)

WHERE THE ACTION IS ON 6 METRES

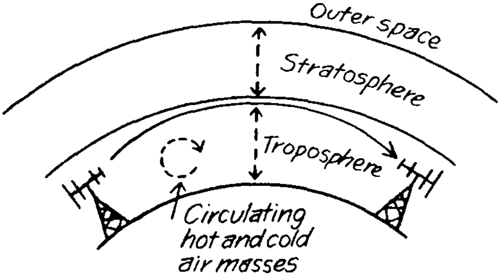
Frequency (MHz)	Type of Activity
52.0 to 52.010	"Earth-Moon-Earth" moon bounce
52.010 to 52.100	Long distance (DX) operation
52.010 to 52.050	Morse code section
52.050 to 52.100	Voice (AM and SSB) section
52.100 to 52.300	Long distance and local operation
52.300 to 52.500	24 hour radio beacons
52.500 to 53.100	Voice (FM) operation
53.100 to 54.000	Future repeaters and linear repeaters
52.025	Morse code calling channel
52.050	Meteor scatter calling channel and USB and AM calling channel
52.075	Radio teletype calling channel

CALLING CHANNELS — You should change to another frequency once you have made contact with someone on the call channel. This leaves the calling channel free for others to establish contact. It also leaves the call channel clear for others who are listening out for a particular station.

52.050	National SSB calling frequency
52.300	Slow Scan Television (SSTV)
52.525	National FM calling frequency
52.656	Voice (FM) secondary frequency

TROPOSPHERIC PROPOGATION

6 metres can produce long distance coverage as a result of weather conditions caused by signals getting trapped and travelling between air layers of different temperatures just near the earth's surface. This is called *tropospheric propogation*. 160, 80, 40, 20, 15 and 10 metres are not as greatly affected by weather conditions of this type as is the 6 metre band.



FREQUENCIES USED ON 6 METRES OVERSEAS:

50.110 MHz	International calling frequency
50 to 54 MHz	United States and Japan
51 to 53 MHz	New Zealand

Over 200 repeater booster stations are operated across the United States. 6 metre repeaters also operate in South Africa.

6 METRE 24 HOUR AMATEUR RADIO BEACONS

(If you've heard all the 10 metre beauties I reckon you'll want to give these a go!)

Location of Beacon *Operator in attendance.	**Call signs are transmitted in morse code each 30 or 60 seconds**	**Frequency (MHz)**
RIO DE JANEIRO	PY1R0	50.003
HONIARA	H44H1R	50.004
*HONOLULU	W6HTH/KH6	50.005
SOUTH AFRICA	ZS1STB	50.010
HAITI	HH2PR	50.023
JAMAICA	6Y5RC	50.025
*SOUTH AFRICA	ZS6PW	50.030
GIBRALTAR	ZB2VHF	50.035
QUITO	HC1JX	50.035
*FRENCH GUYANA	FY7THF	50.037
SOUTH AFRICA	ZS6VHF	50.040
*ANCHORAGE	KL7CTG	50.040
SAN DIEGO	WA6MHZ	50.040
MAINE	WA1EXN	50.050
*SAN FRANCISCO	K6FV	50.050
*SOUTH AFRICA	ZS6LN	50.050
ILLINOIS	WA9FEF	50.055
SOUTH AFRICA	ZS6XJ	50.055
AUCKLAND QRT at 23.00 daily	ZL1UHF	50.055
SAO PAULO	PY2XB	50.058
*NEW ORLEANS	WB5ZRL	50.065
SOUTH AFRICA	ZS3E	50.070
CARACAS	YV5ZZ	50.070
BERMUDA	VP9WB	50.070
*COLUMBIA	W7KMA	50.073
CONNECTICUT	W1AW	50.080
*COSTA RICA	T12NA	50.080
NEW BRUNSWICK	VE1SIX	50.088
NORTH CAROLINA	WD4CEI	50.089
*MICHIGAN	WA8FTA	50.093
*SOUTH AFRICA	ZS6HVB	50.100
*TAHITI	FO8DR	50.100
PEARL HARBOUR	KH6EQI	50.100
*OHIO	N8AJD	50.103
TENESSEE	K4EJQ	50.104
*GUAM	KG6	50.110
*SAIPAN	KH0AB	50.110
*ANCHORAGE	AL7C	50.110
*MIN-TORISHIMA (JARL)	JD1YAA	50.110
*SRI LANKA	4S7EA	50.120
*PONAPE	KC6IN	50.144
CYPRUS	5B4CY	50.500
*AUCKLAND	ZL1BPW	51.002
DARWIN	VK8VF	52.200
PERTH	VK6RTV	52.300

AMATEUR RADIO NEWS BROADCASTS from the Wireless Institute of Australia can be heard each Sunday on 6 metres

Frequency (MHz)	**Coverage area**	**Local time**
52.100	Sydney	11 am & 7.30 pm
52.525	Sydney	11 am & 7.30 pm
52.656	Perth	9.30 am
53.100	Adelaide	9.00 am
—	Melbourne	10.30 am
—	Hobart	9.30 am

The 2 metre band — 144 to 148 MHz

This is a very popular local communicating band because of the operation of amateur repeaters in just about every major populated centre throughout Australia. These repeaters give a coverage of up to 150 kilometres for low power mobile amateurs.

But if you're interested in DX you can try to break the Australian 2 metre distance record of 3,149 kilometres, established when an amateur in Adelaide made contact with an amateur in New Zealand — or why not try for the world record of 6,400km established between amateurs in Puerto Rico and Argentina in South America?

Weather conditions such as air mass, layers of different temperatures, contribute greatly to the long distance coverage on 2 metres. These tropospheric weather effects are more common on 2 metres than on 6 metres. Conversely, the mysterious "sporadic E" long distance occurrence (described in the 10 metre section) is more common on 6 metres than on 2.

As on 6 metres, amateurs around the world on 2 metres are preparing for any possible long distance surprises as the current sunspot cycle peaks around 1982.

WHERE THE ACTION IS ON 2 METRES

Frequency (MHz)	Type of Activity
144.000 to 144.010	Moon bounce (EME)
144.010 to 144.100	Long distance "DX" operating
144.010 to 144.050	Morse code section
144.050 to 144.100	Voice (AM and SSB) section
144.100 to 144.400	Long distance and local operation
144.400 to 144.600	24 hour amateur radio beacons
144.600 to 145.700	Future repeaters and linear repeaters
145.972	The radio beacon aboard OSCAR 7
145.700 to 146.000	Satellite and space communications
145.700	WICEN
145.800 to 145.900	Planned Russian satellite input
145.850 to 145.950	Amateur satellite input (Oscar 7 and 8)
145.925 to 145.975	Amateur satellite output (Oscar 7)
145.900 to 146.000	Amateur satellite input (Oscar 8)
146.000 to 148.000	Voice (FM) operation and repeaters
144.025	Morse code calling channel
144.050	Meteor scatter calling channel
144.075	Radio teletype calling channel
144.100	Primary voice (SSB and AM) calling
144.200	Secondary voice (SSB and AM) calling
144.300	Slow scan television calling
146.000	Popular FM listening channel
146.500	National FM calling channel
146.600	Radio teletype

VHF FREQUENCIES OVERSEAS

Frequency in MHz	
144.000 to 146.000	Europe
144.000 to 148.000	Japan and the U.S.A.
70.025 to 70.700	The British 4 metre band
70.025 to 70.150	Morse code section
70.100 to 70.700	Voice section
220.000 to 225.000	The American 1¼ metre band

2 METRE 24 HOUR AMATEUR RADIO BEACONS

(Are you sure you heard all the ones on 10 and 6 metres? Alright then, these should keep you off the streets for another few years!)

Location of beacon	Call signs are sent in morse code each 30 to 60 seconds	Frequency MHz
SYDNEY	VK2W1	144.010
MOUNT MOWBULLAN, QLD	VK4RTT	144.400
CANBERRA	VK1RTA	144.475
ALBANY, WA	VK6RTW	144.500
VERMONT, VIC	VK3RTG	144.700
SWAZILAND, AFRICA	3D6AX	144.735
MOUNT LOFTY, SA	VK5VF	144.800
OLVERSTONE, TASMANIA	VK7RTX	144.900
DURBAN, SOUTH AFRICA	ZS5VHF	144.925
PERTH	VK6RTV	145.000
AUCKLAND, NZ	ZL1VHF	145.100
WAIKATO, NZ	ZL1VHW	145.150
WELLINGTON, NZ	ZL2VHF	145.200
PALMERSTON NTH, NZ	ZL2VHP	145.250
CHRISTCHURCH, NZ	ZL3VHF	145.300
DUNEDIN, NZ	ZL4VHF	145.400

2 METRE REPEATER CHANNEL NUMBERS AND FREQUENCIES

Repeater Ch. No.		Repeater Input		Repeater Output	
New	Old	Frequency MHz	Channel No.	Frequency MHz	Channel No.
6625	—	146.025	6025	146.625	6625
6650	41	146.050	6050	146.650	6650
6675	—	146.075	6075	146.675	6675
6700	42	146.100	6100	146.700	6700
6725	—	146.125	6125	146.725	6725
6750	43	146.150	6150	146.750	6750
6775	—	146.175	6175	146.775	6775
6800	44	146.200	6200	146.800	6800
6825	—	146.225	6225	146.825	6825
6850	45	146.250	6250	146.850	6850
6875	—	146.275	6275	146.875	6875
6900	46	146.300	6300	146.900	6900
6925	—	146.325	6325	146.925	6925
6950	47	146.350	6350	146.950	6950
6975	—	146.375	6375	146.975	6975
7000	48	146.400	6400	147.000	7000
7025	—	147.625	7625	147.025	7025
7050	73	147.650	7650	147.050	7050
7075	—	147.675	7675	147.075	7075
7100	74	147.700	7700	147.100	7100
7125	—	147.725	7725	147.125	7125
7150	75	147.750	7750	147.150	7150
7175	—	147.775	7775	147.175	7175
7200	76	147.800	7800	147.200	7200
7225	—	147.825	7825	147.225	7225
7250	77	147.850	7850	147.250	7250
7275	—	147.875	7875	147.275	7275
7300	78	147.900	7900	147.300	7300
7325	—	147.925	7925	147.325	7325
7350	79	147.950	7950	147.350	7350
7375	—	147.975	7975	147.375	7375

2 METRE FM (VOICE) REPEATERS IN AUSTRALIA:

Area	**Call Sign**	**Channel New**	**No. Old**	**Power (w)**	**Site**
AUST. CAPITAL TERRITORY					
Canberra	VK1RAC	6900	46	10	Black Hill
A.C.T.	VK1RGI	6950	47	25	Mt. Ginini
NEW SOUTH WALES					
Western Blue Mountains	VK2RDX	6650	41	10	Mt. Binda
Maitland	VK2RPI	6675	—	20	Maitland
Port Macquarie	VK2RPM	6700	42	25	Port Macquarie
Western Plains	VK2RAO	6700	42	50	Mt. Canobolos
Uladulla-Milton	VK2RMU	6700	42	20	Milton
Far South Coast	VK2RFS	6750	43	7	Mt. Alone
Central Coast	VK2RAG	6750	43	30	Somersby
Wagga	VK2RWG	6750	43	10	Mt. Flackney
Lismore	VK2RIC	6800	44	25	Parrots Nest
Sydney South	VK2RLE	6800	44	30	Heathcote
Griffith	VK2RGF	6850	45	8	Griffith
Sth Coast — Tablelands	VK2RAW	6850	45	35	Mt. Murray
Gunnedah	VK2RAB	6850	45	10	Gunnedah
Sydney North Beaches	VK2RMB	6875	—	10	Beacon Hill
Lower Hunter	VK2RAN	6900	46	40	Mt. Sugarloaf
Moree	VK2RMI	6950	47	30	Terri Hi Hi
Sydney North	VK2RWI	7000	48	40	Dural
Blue Mountains	VK2RBM	7050	73	15	Medlow Bath
Westlakes	VK2RWR	7100	74	10	Watigan Ranges
Sydney North Suburbs	VK2RST	7225	—	10	Arcadia
Sydney North Shore	VK2RNS	7250	77	15	Berowra
Southern Highlands	VK2RHR	7350	79	10	High Range
VICTORIA					
Melbourne	VK3RML	6700	42	50	Mt. Dandenong
Ballarat	VK3RBA	6750	43	15	Mt. Bunningyong
Bendigo	VK3RAM	6800	44	40*	Mt. Alexander
Latrobe Valley	VK3RLV	6800	44	40	Mt. Tassie
Mt. Macedon	VK3RMM	6850	45	40*	Mt. Macedon
Swan Hill	VK3RSH	6900	46	40	Swan Hill
East Gippsland	VK3REG	6900	46	25	Mt. Sugarloaf
Grampians	VK3RWZ	6950	47	25	Mt. William
Mildura	VK3RMA	7000	48	100	Mildura Airport
Geelong	VK3RGL	7000	48	400*	Mt. Anakie
Wodonga	VK3RNE	7000	48	25	Mt. Big Ben
Melbourne	VK3RTY	7350	79	—	Mt. Dandenong
QUEENSLAND					
Gold Coast	VK4RGC	6700	42	160*	Mt. Tamborine
Townsville	VK4RAT	6700	42	25	Mt. Stuart
Rockhampton	VK4RAR	6700	42	50*	Rockhampton
Bundaberg	VK4RBU	6800	44	40*	Mt. Goonameman
Ipswich	VK4RAI	6900	46	20	Mt. Crosby
Gladstone — Biloela	VK4RGB	6900	46	—	Gladstone
Brisbane	VK4RBN	7000	48	100*	Mt. Glorious
Cairns	VK4RCA	7000	48	—	Mt. Bellenden-Ker
Mackay	VK4RMK	7000	48	—	Mackay
Toowoomba	VK4RDD	7100	74	40*	Toowoomba
Brisbane	VK4RBT	7250	77	—	Brisbane
SOUTH AUSTRALIA					
Mid. North	VK5RMN	6700	42	10	The Bluff
Adelaide	VK5RHO	6850	45	25	Houghton
Adelaide	VK5RAD	7000	48	15	Crafers
Alice Springs	VK5RCA	7000	48	20	Alice Springs

2 METRE FM (VOICE) REPEATS IN AUSTRALIA: (continued)

WESTERN AUSTRALIA					
Perth	VK6RAP	6700	42	40	Roleystone
Perth	VK6RAH	6800	44	40	Roleystone
Albany	VK6RAA	6800	44	40	Mt. Barker
Bunbury	VK6RBY	6900	46	25	Mt. William
Perth	VK6RPD	6950	47	40	W.A.I.T. Bently
Wagin	VK6RAW	7000	48	25	Mt. Latham
Kalgoorlie	VK6RAK	7000	48	40	Kalgoorlie
Geraldton	VK6RGN	7000	48	15	Geraldton
Perth	VK6RWC	7100	74	15	Double View
TASMANIA					
Hobart	VK7RHT	6700	42	70	Mt. Wellington
North West Coast	VK7RNW	6750	43	30	Ulverstone
North East Coast	VK7RAA	7000	48	60	Mt. Barrow

TIME OUT PERIOD

You'll notice that the letter 'R' follows the number in the call sign. 'R' means *repeater*.

Because repeaters are in heavy demand by many amateurs, they have what is called a *time out* period which means that if you talk continuously for more than a certain amount of time the repeater will close down until you stop transmitting. This is done to give everyone a fair chance to use the repeater. The time out period is normally around 3 minutes.

AMATEUR RADIO NEWS BROADCASTS from the Wireless Institute of Australia can be heard on 2 metres

Frequency (MHz)		Coverage Area	Local Time
144.100		SYDNEY	11 am & 7.30 pm Sun
144.200		MELBOURNE	10.30 am Sun
146.500		CANBERRA	8 pm Sun
146.500		SYDNEY	10.30 am & 7.30 pm Sun
146.500		DARWIN	9 am Sun
Repeater Channel No.			
New	**Old**		
6700	2	MELBOURNE	10.30 am Sun
6700	2	PERTH, W.A.	9.30 am Sun
6750	3	BALLARAT, VIC	10.30 am Sun
6750	3	GOSFORD, NSW	7.30 pm Mon
6750	3	DEVONPORT, TAS	9.30 am Sun
6900	6	NEWCASTLE, NSW	7.30 pm Mon
7000	8	SYDNEY	11 am & 7.30 pm Sun
7000	8	ADELAIDE	9 am Sun
7000	8	LAUNCESTON, TAS	9.30 am Sun
Several Repeater Channels		QUEENSLAND	9 am Sun

ULTRA HIGH FREQUENCY (UHF) AMATEUR BANDS

To operate on UHF bands you must have a Full or Limited licence.

The 70 centimetre band — 420 to 450 MHz

(Popularly known as the "432 MHz band")

70 centimetres is the first of the amateur UHF bands, it provides a good

coverage for mobile local communications. Like 2 metres, repeaters are appearing around Australia on this band. An interesting aspect of 70 centimetres is that it often provides coverage into areas which 2 metre signals can't reach.

A distance of 4087 kilometres has been reached on 70 centimetres by an amateur in California who picked up an amateur on the Hawaiian Islands. This was not a two-way contact so the world record is only 2470km made in 1978 between one amateur in Victoria and another in Western Australia.

Long distance low power tropospheric communicating is an exciting aspect of 70cm operating.

70 centimetres is one of the popular ATV bands.

Just think, you could be sitting there in front of your camera and suddenly someone 400 kilometres away comes through on your TV screen. Why not have a go at trying to break the Australian amateur television distance record? Anything over 413km will do it!

The present record was established when an amateur in Victoria made a two-way television contact with an amateur in Tasmania using only 600 milliwatts of power.

Even my nine year old daughter's walkie talkie has more power than that!

WHERE THE ACTION IS ON 70 CENTIMETRES

Frequency (MHz)	Type of Activity
420.000 to 432.000	Amateur Television (Channel 1) (picture on 426.25Mhz, voice on 431.75MHz)
432.000 to 432.010	Moon bounce (EME)
432.010 to 432.050	Long distance 'DX' operating morse code section
432.025	Morse code calling frequency
432.050	Meteor scatter calling frequency
432.050 to 432.100	Long distance voice operating
432.075	Radio teletype calling channel
432.100	Voice SSB and AM calling
432.100 to 432.400	Local and long distance section
432.125 to 432.175	Amateur satellite input (OSCAR 7)
432.200	Secondary voice SSB and AM calling
432.300	Slow scan television calling
432.400 to 432.600	24 hour radio beacons
432.600 to 433.000	Local operating
433.000 to 435.000	FM voice repeater input frequencies
435.095	Radio beacon aboard the Oscar 8 satellite
435.000 to 438.000	Satellite and space communications
435.100 to 435.200 MHz	Amateur satellite output (Oscar 8)
438.000 to 440.000	FM voice repeater output frequencies
440.000 to 441.000	FM voice operating
441.000 to 443.000	Experimental use
443.000 to 450.000	Amateur Television (Channel 2) (picture on 444.250MHz, voice on 449.750 MHz)

Frequencies currently being used for FM voice communicating are 433.5, 433.55, 435 and 438 MHz.

70 CENTIMETRE 24 HOUR AMATEUR RADIO BEACONS

(O.K. you ultra high frequency freaks, see if you can tune in these gems!)

Location of Beacon	**Call signs are in morse code each 30 to 60 seconds**	**Frequency (MHz)**
BALLARAT	VK3RBG	432.125
BRISBANE	VK4RBB	432.400
MT. BAINBRIDGE	VK3RWV	432.435
ULVERSTONE	VK7RTW	432.475
WELLINGTON, NZ	ZL2UHF	433.000
WAIKATO	ZL1VHW	433.150
AUCKLAND	ZL1VHF	433.100
CHRISTCHURCH	ZL3UHF	433.200
MANAWATA	ZL2VHP	433.250

70 CM FM VOICE REPEATERS IN AUSTRALIA

Coverage Area	**Frequency INPUT**	**Frequency OUTPUT**	**Call Sign**
Central Coast	433.050	434.650	VK2RUG
Wollongong	433.225	438.225	VK2RUW
Sydney	433.525	438.525	VK2RUS
Melbourne	433.525	438.525	VK3RAD
Brisbane	433.525	438.525	VK4RBC
Gold Coast	433.525	438.525	VK4RGC
Melbourne	433.675	438.675	VK3RMU

AMATEUR RADIO NEWS BROADCASTS from the Wireless Institute of Australia can be heard each Sunday on 70cm in Sydney at 7.30pm on 432.1 MHz. There is also a broadcast in Newcastle each Monday at 7.30pm on 435.00.

Enterprising amateurs will no doubt obtain UHF CB sets and modify them for amateur use. A popular 70cm project is to modify UHF TV sets for amateur TV transmissions. If you can't get hold of a UHF TV set, add a converter to your ordinary set.

The 51 centimetre band — 576 to 582 MHz

(Popularly known as the "576 MHz band")

Long range contacts over 1000 kilometres may be possible on this band as a result of 'tropospheric ducting'. Here a warm mass of air can overtake a cooler mass and along such a weather front VHF or UHF signals can be bent and returned to earth up to 1000 miles away. Often ducting works better on 70 centimetres or 2 metres, but at other times 51 centimetres will produce an unexpected surprise.

(At present the Australian distance record is only 314 kilometres and I reckon it's just waiting to be broken . . . first in first served!)

51 centimetre enthusiasts enjoy cross band and repeaters mixed in a very special way. A low power television signal is transmitted on 70 centimetres and is picked up by the TV repeater which re-transmits the two-way television signals on to the 51 centimetre band. *(This just has to be the closest thing to having your own two-way video telephone!)*

The 23 centimetre band — 1215 to 1300 MHz

(Popularly known as the "1296 MHz band")

The frequencies above 1000 MHz are known as *microwaves*. 23 centimetres is the first of these exciting microwave bands.

Using very low power and physically small antennas, you can cover very large distances during tropospheric occurrences. Australian amateurs smashed the world record by covering 1.881 kilometres between Adelaide and Albany, W.A.

23 centimetres is also popular for moon-earth-moon bouncing, if you want to say 'hello' to the man in the moon. (For full details see Chapter 12.)

AMATEUR RADIO NEWS BROADCASTS from the Wireless Institute of Australia can be heard each Sunday on 23 centimetres in Sydney at 7.30 pm on 1296 MHz.

24 HOUR UHF AMATEUR RADIO BEACONS OPERATING IN THE UNITED KINGDOM

(If you can hear any of these, then you've smashed the world record on 23 centimetres into a million pieces!)

Call sign	Frequency (MHz)
GB3AND	1296.87
GB3DD	1296.89
GB3WRN	1296.91

You can achieve a distance of over 16,000 kilometres on this band, as well as on 2 metres and 70 centimetres, by bouncing your signals off the moon and talking to people in America.

The 13 centimetre band — 2300 to 2450 MHz

(Popularly known as the "2.3 Gigahertz band")

On the second of the microwave bands using an incredibly low 3 watts of power to a small antenna, Australian amateurs again shattered the world distance record in 1978 by covering the same 1,881 kilometres between Adelaide and Albany which had made history on the 23 centimetre band a year earlier.

Always on the lookout for interesting features on the daily weather map which might produce long distance tropospheric conditions, the microwave 13 centimetre enthusiast is ever ready to race up to his nearest mountain with the hope of breaking personal or world records.

The radio beacon aboard the Oscar 7 satellite is on 2304MHz.

This band is much favoured by EME enthusiasts.

SUPER HIGH FREQUENCY (SHF) AMATEUR BANDS

To operate on SHF bands you must have a full or limited licence.

The 9 centimetre amateur band — 3300 to 3500 MHz

(Popularly known as the "3.4 Gigahertz band")

The 9 centimetre band is the first of the amateur super high frequency allocations.

Two New Zealand amateurs currently hold the world record of 447 kilometres on 9 centimetres.

24 HOUR AMATEUR RADIO BEACON IN THE UNITED KINGDOM

(You'll make the Guiness Book of Records when you pick up this one.)

Call Sign	Frequency (MHz)
GB3UOS	3456.0

The 5 centimetre amateur band — 5650 to 5850 MHz

(Popularly known as the "5.7 Gigahertz band")

The world record on this band is 344 kilometres. As on the 9cm band, it's those good old tropospheric conditions that carry signals over long distances.

As more people build their own equipment on this band, more of these unusual conditions will be intercepted and this record will be pushed even further.

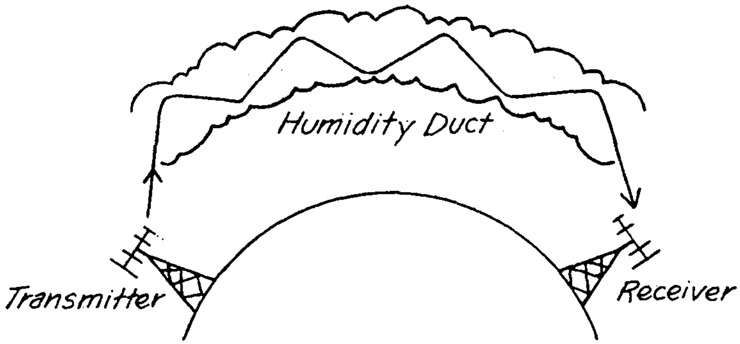
The 3 centimetre amateur band — 10,000 to 10,500 MHz

(Popularly known as the "10 Gigahertz band")

Although the 3cm band is best known for line of sight communication a tremendous amount of new DX activity is taking place in this part of the microwave bands. Already the world distance record has shot up to 521 kilometres using only 15 milliwatts — showing what is yet to be accomplished in the 9 and 5 centimetre bands.

DX contacts using super refraction (or bending of microwaves) due to humidity ducts are extremely popular on this band.

What, you may well ask, is a humidity duct? In fairly simple terms a humidity duct is the result of an unusual atmospheric occurrence in which radio waves get trapped between moist air lying between a water or land surface and the relatively dry air above.



Very low power signals, around 5 to 10 milliwatts, can be transmitted for hundreds of miles within the duct.

The 3 centimetre enthusiasts looking for DX on the 10,000 MHz amateur band enjoy searching for interesting portable sites where they can operate. Sea level is particularly popular.

If wind speed is low, (preferably wind coming off the land, since wind coming off the sea is more highly water saturated) and if an orange-brown band can be seen in the horizon — then the 10,000 MHz skip is in for sure! Elevated fog clouds have been used to carry 10,000 MHz transmissions across the English Channel between England and France.

In the United Kingdom, over 10 different countries have been contacted across the English seas into the European continent and much scope exists for cross-country long distance coverage through ducts which may form over land.

WHERE THE ACTION IS ON 3 CENTIMETRES

Frequency (MHz)	Type of Activity
10,000 – 10,100	Long distance operating
10,035	Popular calling channel
10,065	Popular calling channel
10,100	24 hour amateur radio beacons
10,250	Popular calling channel
10,350	Popular calling channel
10,380	Popular calling channel

24 HOUR AMATEUR RADIO BEACONS IN EUROPE

(Marconi would turn in his grave if you score here.)

Location	Call sign	Frequency (MHz)
AMSTERDAM	PAHSM	10,100
CHANNEL ISLANDS (ALDERNEY)	GB3ALD	10,100
London	GB3LBH	10,100
Isle of Wight	GB3IOW	10,100

The 1.25 centimetre amateur band — 24,000 to 24,250 MHz

(Popularly known as the "24 Gigahertz band")

Being the highest frequency allocated around the world for amateur use, 1.25 centimetres represents the edge of the universe for many radio amateurs. It's this fascination of the mysterious that inspires the exploration of this newest available amateur allocation.

What will amateurs find on this band which is 14,000 MHz above the 3 centimetre band? The challenges are tremendous — already two British amateurs have set a world record of 154 kilometres using a few milliwatts of power.

EXTRA HIGH FREQUENCY (EHF) BANDS

To encourage the exploration of the relatively unknown millimetre bands, several new bands have been allocated to amateurs in the United States. Known as the Extra High Frequency (EHF) bands, these new frequencies are largely over the edge of our current knowledge — just as the short wave bands of 200 metres and below were to the early amateurs of the 1900s.

If you hold a full or limited licence you can explore these uncharted frequency bands here in Australia by applying for special permission from the Postal and Telecommunications Department.

EXTRA HIGH FREQUENCY BANDS

Band Wave length in millimetres	Frequency in Megahertz (MHz)	Frequency in Gigahertz (GHz)
6.7	40,000 to 50,000	40 to 50
4.0	71,000 to 76,000	71 to 76
1.9	155,000 to 160,000	155 to 160
1.4	216,000 to 220,000	216 to 220
1.2	240,000 to 250,000	240 to 250
All the wavelengths below 1.1	All frequencies above 275,000	All above 275

VERY LOW FREQUENCY (VLF)

The 1875 metre band — 160 to 190 KHz

Well, you've gone about as high as you can go with EHF bands — how about looking at the other end of the scale?

Far below the 160 metre band and the broadcast band is a range of frequencies from 160 to 190 KHz known as the 1875 metre band. What mysteries are hidden in these depths? There must be a lot of people who would like to find out. Some American amateurs are already exploring the VLF band. Why not join them?

(If you're really keen, and you have a full amateur licence, you could apply to the Department of Post and Telecommunications. I'll keep my toes crossed for you!)

Chapter 8

Homebrewing

Homebrewing

You've just built your very first radio receiver and your finger is trembling ready to press the 'on' switch. The moment of truth is at hand. Will it work? Will it blow up? Go on now . . . press the button . . . it works! It's a real life human voice and you made it speak. You gave it life just by connecting a few electronic components.

(Okay, I admit maybe it's not quite that simple – but millions of other people do it, so why not you?)

That's what '*homebrewing*' is all about — building up your own equipment, modifying, experimenting and always trying to make things work better and get further.

If you lack the ready, but have the spare time, 'homebrewing' can save you literally hundreds of dollars.

WHAT TO HOMEBREW?

Once you have any level of amateur licence you can legally modify transceivers. It is not necessary to inform the licencing authorities every time you build or buy or modify a new transceiver. Your amateur licence allows you to have as many transceivers as you like.

CONVERTING CB RADIOS ONTO AMATEUR BANDS

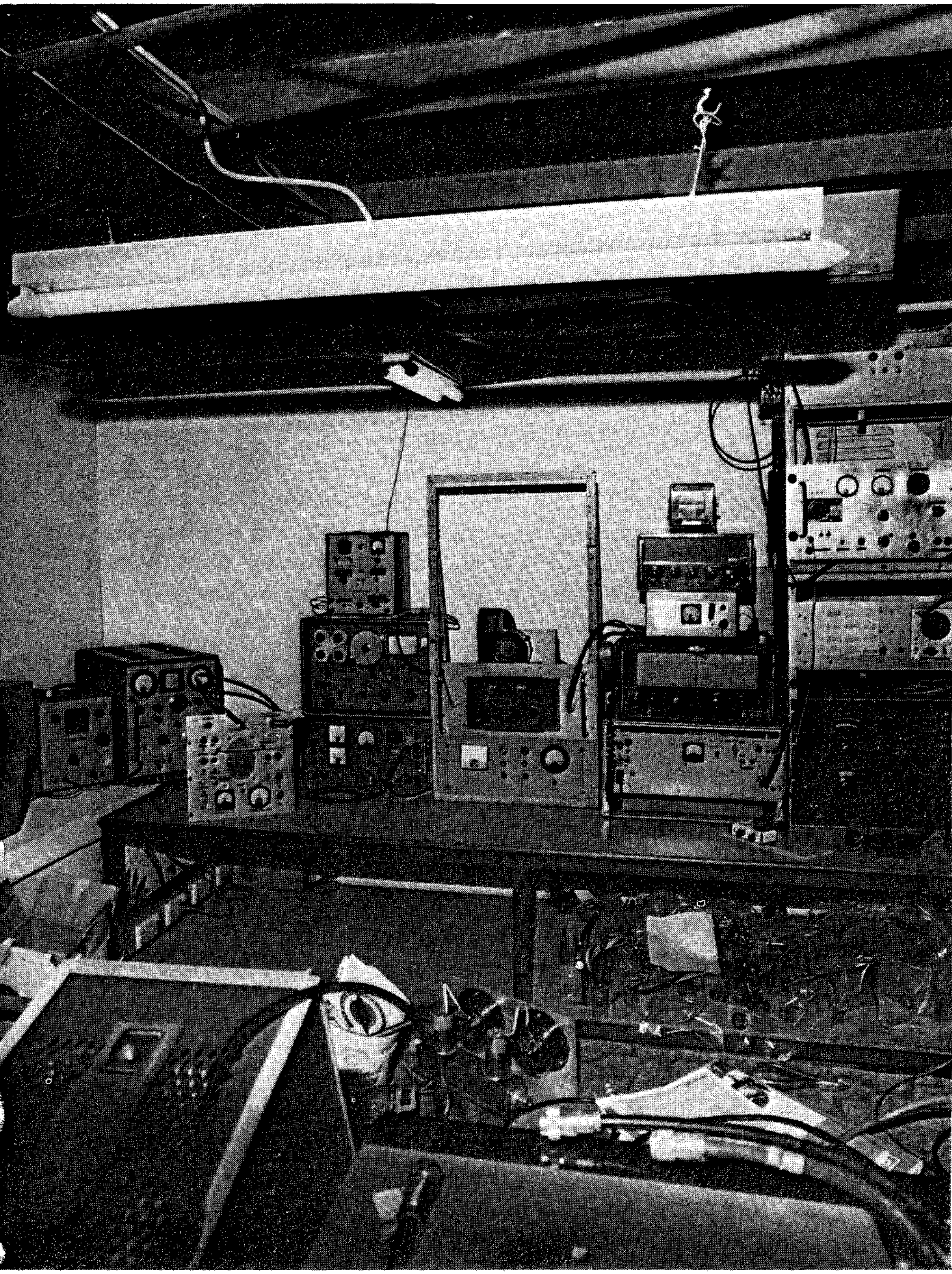
Your novice licence is hanging up on your bedroom wall and you could well be wondering what on earth you can do with your old twenty three channel CB radio.

Well, what are you waiting for? — Remember all the things you learned when you were studying for the novice licence? They said it's really easy to convert CB radios onto the popular worldwide 10 metre band if you know what you're doing. You should — you've just got your novice licence to prove it!

Pop in these crystals here, align these tuned circuits there, flick the power switch on and . . . "This is HK6AA in Columbia, South America". Boy! It works — South America on my converted CB radio, incredible!"

THE COST?

Your new crystals won't cost you too much but you'd better know what you're doing or you'll butcher your transceiver to death.



A view of a typical homebrew station showing the transmitter on the right and measuring/test equipment on the left.

GETTING A CB ONTO 80 METRES

You're getting tired of struggling with foreign languages? So why not convert a CB onto the 80 metre novice band and make contacts all around Australia?

You'll need an 80 metre transverter, and you're practically home and hosed.

What's next? How about changing the crystal and a few of the coils in the 80 metre transverter to get onto the 15 metre novice amateur band.

It worked! It worked! You're getting all over Europe on 15 metres.

And on and on it goes — that's the way things are with homebrewing. Once you've got your full amateur licence you could multi-band your transverter so you can operate on 160, 80, 40, 20, 15 and 10 metres all from a converted CB radio.

HOMEBREW PROJECT INFORMATION

The purpose of this book is not to tell you exactly how to perform all these miracles. *(I'm just trying to get you as excited about homebrewing as I am.)* You will learn some radio techniques in the course of studying for your licence, but each month magazines are available packed with very detailed and completely explanatory articles on various homebrew projects.

The following are recommended:

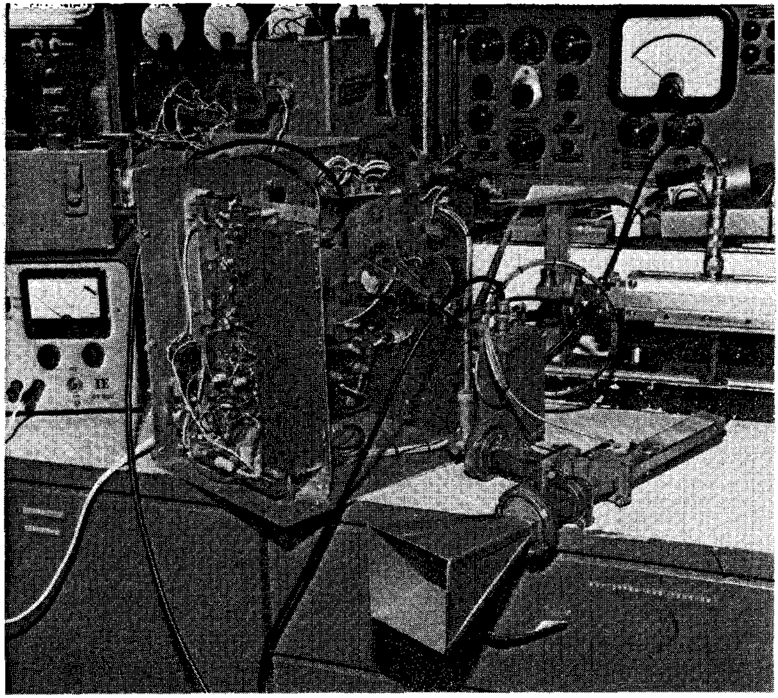
- *Amateur Radio* (The free monthly magazine sent to all members of the WIA. For details on how to join see page 156).
- *Electronics Australia*
- *Electronics Today International*
- *Amateur Radio Action*

Basic instructions for homebrewing two of the most popular antennas are given in Chapter 9, ANTENNAS.

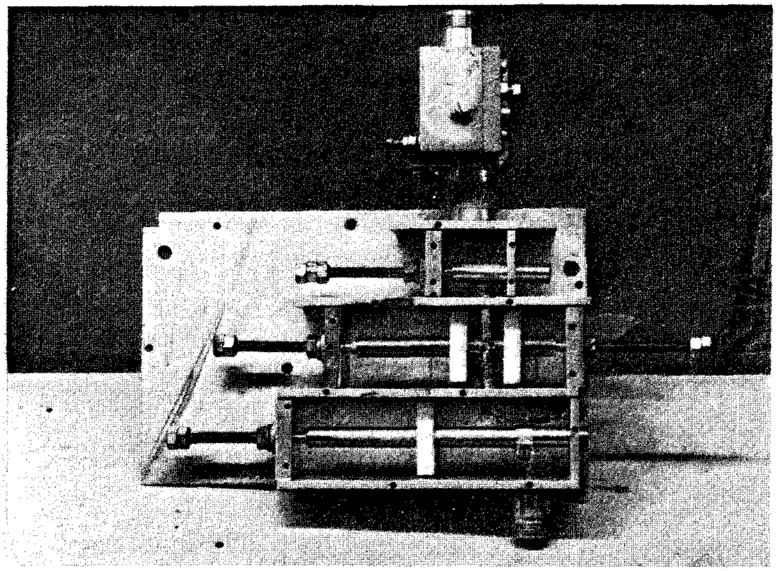
A word of warning: *Do not build projects from overseas magazines until you make sure that all the parts (or their equivalent) can be bought in Australia.*

SAFETY

Always be careful with 240 volt equipment. Electrical wiring should never be exposed. If you're a beginner, why not start off with the relatively safer 12 volt transistorized projects.



A homebrewed microwave transmitter showing the wave guide transmission line and the horn type antenna.



A homebrewed microwave frequency multiplier showing the tuned cavities and tuning rods.

Would you believe . . . a modified CB radio for use as a bicycle mobile?

Chapter

9

Antennas

Antennas

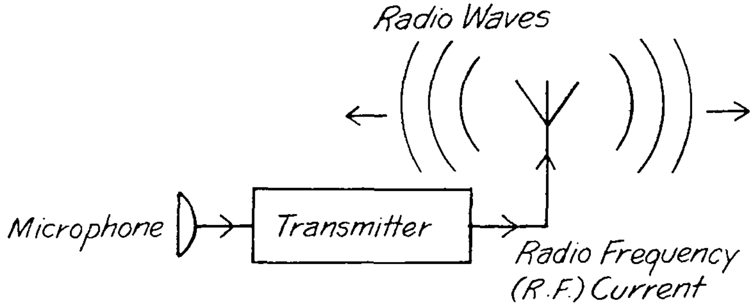
That magical length of wire, commonly called an antenna, is a crucial factor in getting the very best out of your radio station.

There are thousands of different antennas you can buy or make — some that look like TV antennas (called *beam* antennas), others are like the ordinary aerial on your car (a *whip* antenna) and others that are just lengths of wire called long wire antennas. If the length of a beam antenna is too long to use rigid tube (as in a TV antenna) wire can be used. This is a dipole antenna.

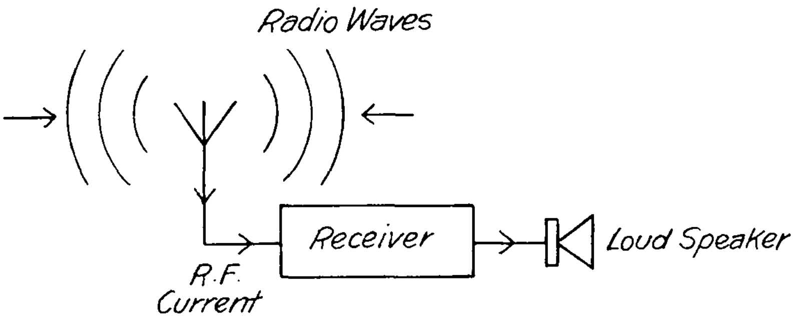
The results you get from your transmitter and receiver are directly related to the type of antenna you install.

The following diagrams illustrate basic antenna principles.

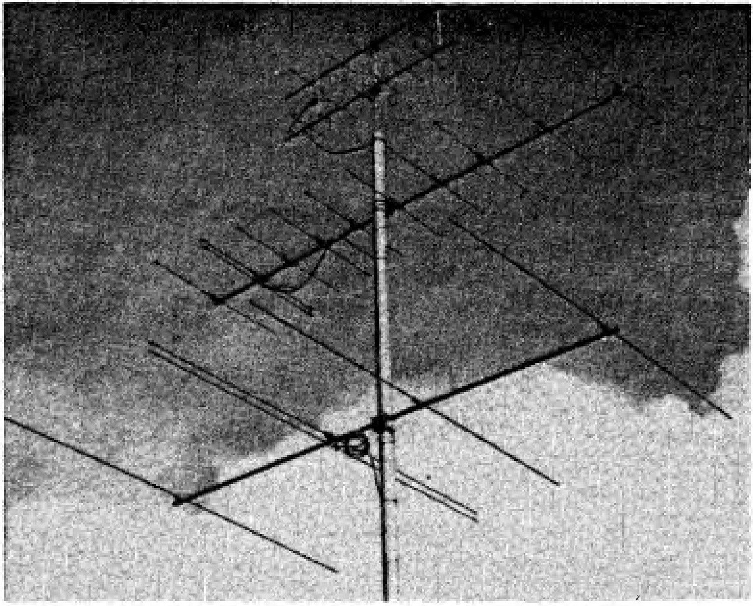
When the antenna is used for transmitting, the transmitter's job is to send a radio signal along the antenna and so produce radio waves.



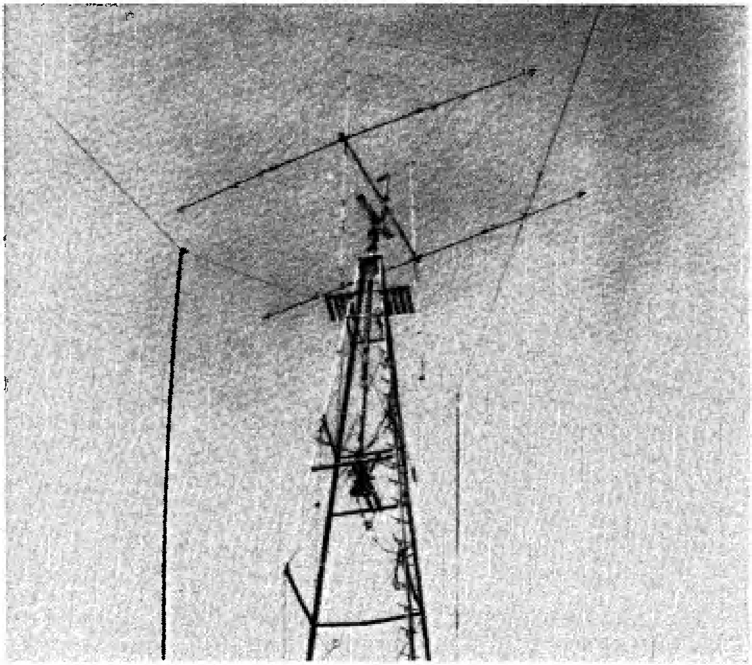
When the antenna is used for receiving, the antenna captures the radio waves and produces signals. The receiver's job is to change these signals back into speech or code.



One antenna can be used for both transmitting and receiving. A relay (or a switch) is normally used to connect the antenna to either the



One of the main advantages of VHF is the relatively small size of the antennas used. Illustrated is a 4 element 6 metre yagi, a 10 element 2 metre yagi (both using folded dipoles) and an 8 over 8 70 centimetre antenna using a skeleton slot feed.



A typical amateur antenna set up showing a 15 metre tower with a 2 element 3 band quad, horizontal dipoles and a rotating mechanism.

transmitter or receiver. This relay inside a transceiver is called the antenna changeover relay.

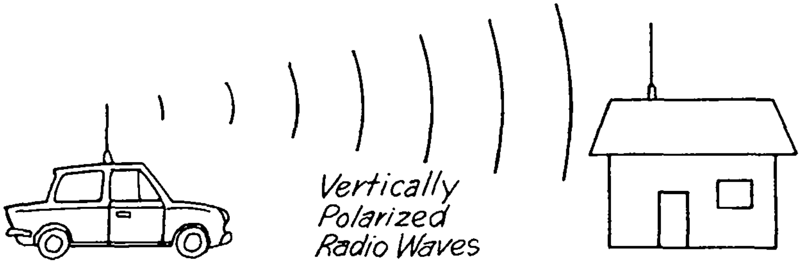
WHAT MAKES ONE ANTENNA WORK ON ONE BAND BUT NOT ANOTHER?

Its length. Yes, you need a certain length of antenna (related to its wavelength) for each band of frequencies on which you would like to operate. In some cases the antenna is physically the required length, but in most cases it is much shorter and made to the electrical equivalent of the physical length using a device called a loading coil.

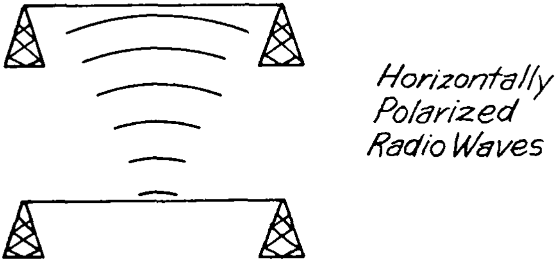
POLARIZATION

Aerials such as whip antennas on cars go straight up into the air. They are vertical antennas and the radio waves which leave them are said to be vertically polarized.

This means that if you transmit vertical signals then they will be received best by people who are using vertical antennas.



Antennas such as most TV aerials are parallel to the ground. They are horizontal antennas and the radio waves which leave them are said to be horizontally polarized. This means that if you transmit horizontal signals then you will be received best by people who are using horizontal antennas.



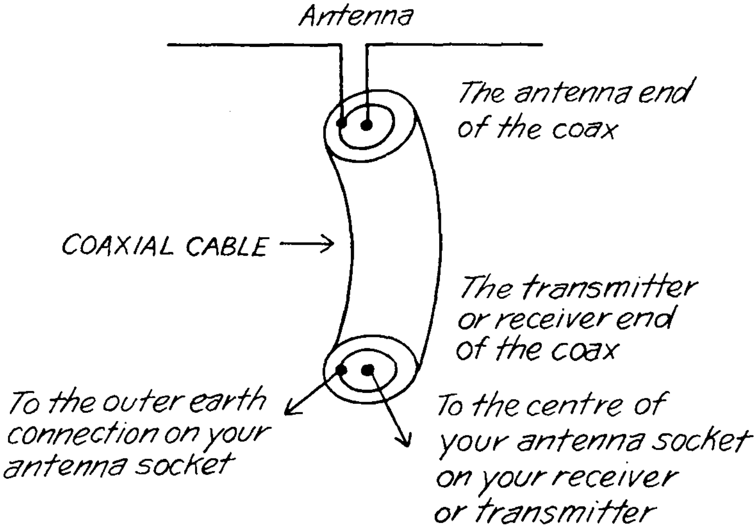
HOW IS THE ANTENNA CONNECTED TO THE TRANSCEIVER?

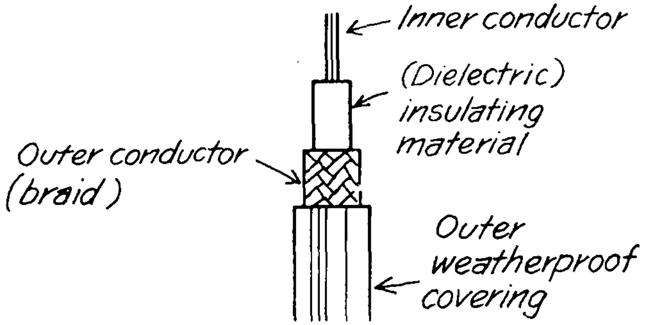
The antenna is normally connected to the transceiver by a special conducting cable called co-axial cable, sometimes called a transmission or a feed line.

The co-axial cable makes sure that none of the signal is radiated until it reaches the antenna. The job of the coax cable is to carry the radio signal up to the antenna.

Co-axial cables consist of two concentric conductors which are not connected to each other and are separated by an insulator.

The inner conductor takes the radio current to one end of the antenna. The outer conductor (called the earth braid) connects the other end of the antenna to the case of the transceiver.


Antenna
The antenna end of the coax
COAXIAL CABLE
The transmitter or receiver end of the coax
To the outer earth connection on your antenna socket
To the centre of your antenna socket on your receiver or transmitter



There are two main types of co-axial cable — 50 ohm and 75 ohm, each is used for a different type of antenna.

TYPES OF ANTENNAS

Dipole

This is the most popular and effective antenna for around Australia communication on the 160, 80 and 40 metre bands.

A dipole is normally two equal lengths of wire where one length is connected to the centre of the coax cable and the other connected to the outer conductor of the coax.

(See page 114 for diagram and instructions on how to homebrew your own.)

Ground Plane

This type of antenna consists of a vertical piece of wire (or any metallic conductor) which is connected to the centre of the coax cable. Several horizontal or sloping sections of wire, called the ground plane, are connected to the outer conductor of the coax cable. (See page 119 for diagram and homebrewing instructions.)

This is the simplest antenna for both local communication (because it is not directional) and worldwide contacts (because of the low angle at which the signals radiate).

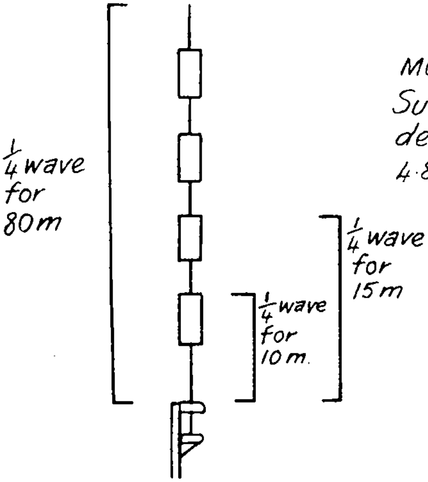
On the 20, 15 and 10 metre bands the ground plane antenna is ideal for mobile communication. It is also particularly popular for use on the 6 and 2 metre VHF bands as well as the 70, 51, and 23 centimetre UHF bands.

There are three different lengths of ground plane antennas — ¼ wave, ½ wave and ⅝ wave.

Multi-band Trap Verticals

A popular antenna where space is a problem is the trap vertical. Traps consist of a coil connected across a capacitor — it's called a tuned circuit and it traps or stops radio waves of certain frequencies. The trap is placed at a certain point along the antenna so as to make it act like a quarter wave vertical antenna for the frequency on which you want to operate.

To operate on 10 metres, the 10 metre trap stops the signal from getting above the trap at a point which is electrically a quarter wavelength long but physically can be much shorter. The next trap is tuned to 15 metres and blocks 15 metres at a quarter wavelength up the antenna, then next is 40m and finally the whole antenna is used for 80 metres.


$\frac{1}{4}$ wave for 80m
$\frac{1}{4}$ wave for 10 m.
$\frac{1}{4}$ wave for 15m

MULTI-BAND TRAP VERTICAL

Such an antenna can be designed to be only 4·8 metres in height

To include the 160m band a coil can be added to the base of the antenna.

Beam

A beam antenna concentrates your transmission in the direction of the geographical area in which you would like your signals to be received.

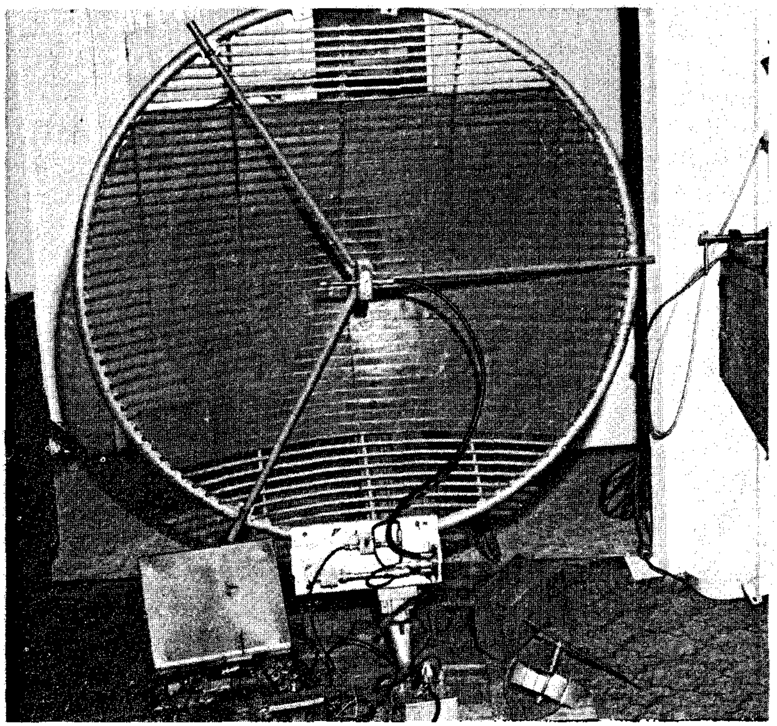
Beam antennas are available for around the world communicating on the 40, 20, 15 and 10 metre bands. Satellite and moon working antennas using VHF and UHF are also available.

Beam antennas can be used with various rotators (remotely controlled motors to turn antennas) and rotating indicators so that you can see which way your antenna is pointing without having to take a look outside your window all the time.

To operate on several of the HF bands (normally 20, 15 and 10) it is possible to use only one beam antenna by employing the same principle as used in the trap vertical antenna described earlier.

Dish

This type of antenna is basically a dipole with a dish shaped reflector behind it — it looks rather like a radio telescope. The dish can be quite small — only a metre or so in diameter. A dish antenna allows you to concentrate your signals strongly in one direction.



A homebrew parabolic dish reflector antenna during construction.

These antennas are used on the 23 and 13cm UHF bands and on the 9, 5, 3 and 1.25cm SHF microwave bands.

(That's exactly how I got through to Boris's ex-contact in the Kremlin last night. The news? Boris has moved to Hoboken, New Jersey, USA, and a bloke with an American accent has just turned up in Siberia. An exchange job?)

Good instructions on how to build dishes are described in the *RSGB VHF-UHF Manual* available from most electronic stores.

Mobile

Short antennas are normally used when operating from a car (mobile), boat (maritime mobile) or plane (aeronautical mobile).

Mobile antennas for HF, covering 80, 40, 20, 15 and 10 metres can be obtained so that all you need to do is screw out one coil and then screw in another. The 80 metre centre loaded whip can be top loaded to function on 160 metres or an antenna tuner (see below) can be used to base load the antenna for 160 metre use.

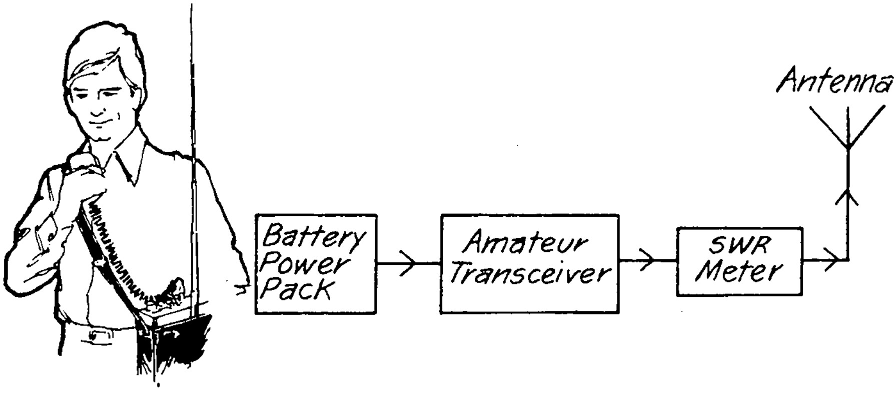
The popular 11 metre CB antennas can be easily modified to 10 metres by shortening the top section.

A variety of VHF and UHF mobile antennas using ¼ and ⅝ wavelengths are also available.

Handheld/pedestrian

If you want to operate long distance you can use an 11 metre mobile CB whip antenna connected to a CB antenna matcher. This works beautifully on the 10 metre band.

For local communication on the 2 metre band you can easily strap a quarter wave vertical antenna to a supporting plastic pole which would protrude out of the over-the-shoulder bag holding the rest of your gear.



ANTENNA TUNERS

Antenna tuners are designed to match your transceiver to virtually any length of wire so that just one wire antenna can be used from 160 through to 10 metres.

These are quite handy for portable operating and will get you on the air when space to put up a full sized antenna is not available.

POPULAR ANTENNA TERMS

Omnidirectional — means that the aerial works well in all directions.

Directional — means that the antenna favours signals which are coming from a certain direction.

Gain — this is the improvement in signal strength obtained by one antenna over another.

Beam antennas are often said to have a forward gain because they concentrate or beam out the signal in one forward direction.

Front to Back Ratio — this is a comparison of how much of the radio signal is being transmitted forward compared to how much is being lost in the other direction. A beam antenna should of course send most of its signals forward.

Standing Wave Ratio — this is often abbreviated to SWR. It is a measure of the electrical compatability between the antenna and the transmitter.

Antenna Band Width — if an antenna has a low SWR across a whole range of frequencies, then the antenna is called a broadband antenna.

When you make up an antenna or buy one, the antenna may be able to operate over a wide range or a small range of frequencies with a reasonably low SWR.

Impedance — most transceivers are made to accept antennas having an impedance of 50 or 75 ohms.

If a transceiver is designed for an impedance of 50 ohms this means that to be able to transfer all the power out of the transceiver into the antenna — the co-axial cable should be 50 ohms and the antenna should also be 50 ohms. In practice you may find that both 50 and 75 ohm antenna types can be adjusted for reasonable operation with your equipment.

Decibel (dB) — this is the term used to describe relative strength or power levels.

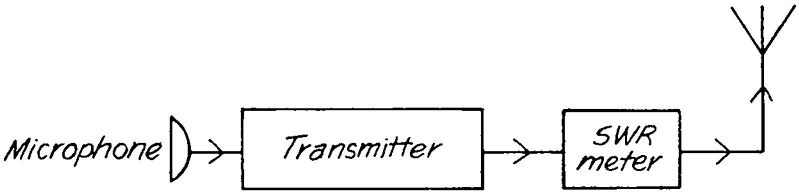
USING AN SWR METER

Antennas must be adjusted to accept the maximum power from the transmitter, otherwise the set won't give maximum performance and may even be damaged.

Antennas are very easily adjusted by using an SWR (standing wave radio) meter. *(Sounds fancy, doesn't it? But don't worry – the SWR meter is quite friendly, simple and cheap to build or buy.)* It just tells you how much power is being accepted by the antenna (this is the forward switch position) and how much is being rejected by the antenna (this is the reverse switch position).

If the antenna is properly adjusted then very little of the signal will be rejected by the antenna.

The SWR meter is connected between the transmitter and the co-axial cable which goes off to your antenna.



With the SWR switch on 'forward' you adjust the sensitivity control so that the meter pointer lies on the 'set' marking near the top of the SWR scale. Then you flick the switch to 'reflected' to read your SWR from the meter . . .

- A reading of 1.0 means no signals are being rejected by the antenna
- A reading of 1.5 means only a bit is being rejected
- A reading of 2.0 means only a moderate amount is being rejected

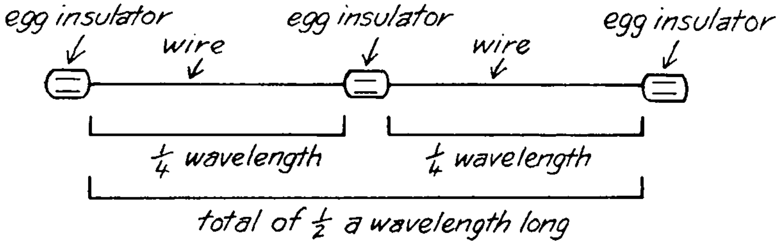
These readings and adjustments are done as you transmit a steady signal into your antenna. A reading of 1.5 is an excellent result, a reading of 2.0 will not damage your equipment but if your reading is above 2.0 or 3.0 you must tune your antenna or you'll have poor results and possible damage to your transmitter.

ANTENNA HOMEBREWING

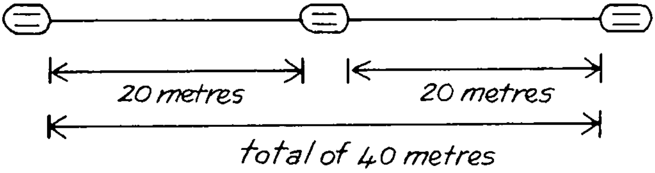
A lot of amateurs are very keen on making their own antennas. Unfortunately, there's not sufficient space in this book to go into this subject in any great depth. However, let's get to grips with the two most popular antennas — the half wave dipole and the quarter wave ground plane.

HALF WAVE DIPOLE ANTENNA

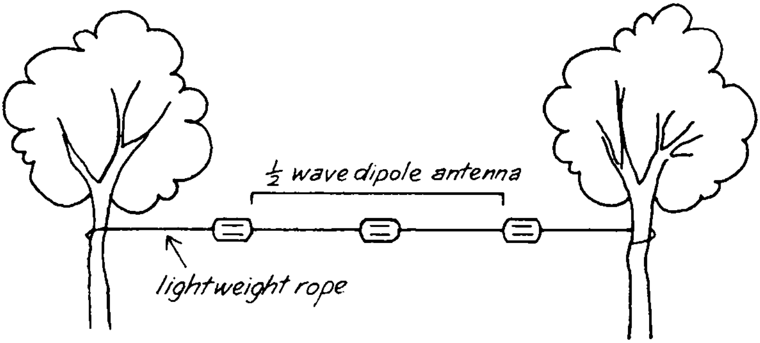
A half wave dipole antenna is easily made up by getting two pieces of wire each a quarter wave length long (making a total length of a half wave length).



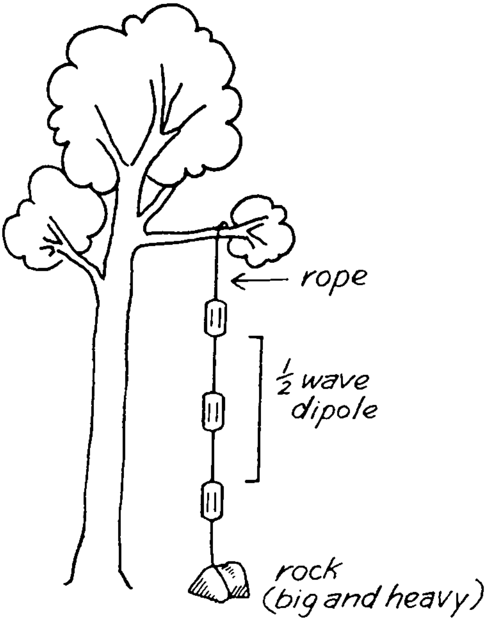
For example, on 80 metres a half wave dipole on 3.6 MHz would be about 40 metres long.



At the end of the dipole antenna you connect an insulator which is a material which does not conduct electricity. String, fishing line or rope is connected to the insulator and run across to a tree or some high position so that the dipole antenna can be supported high up in the air.

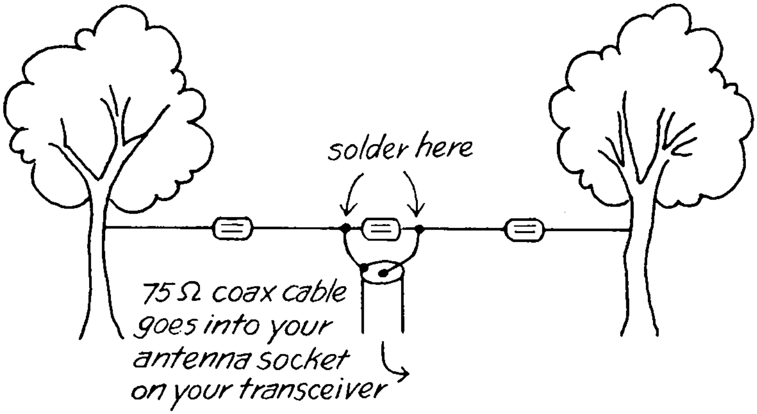


This dipole antenna is supported horizontally

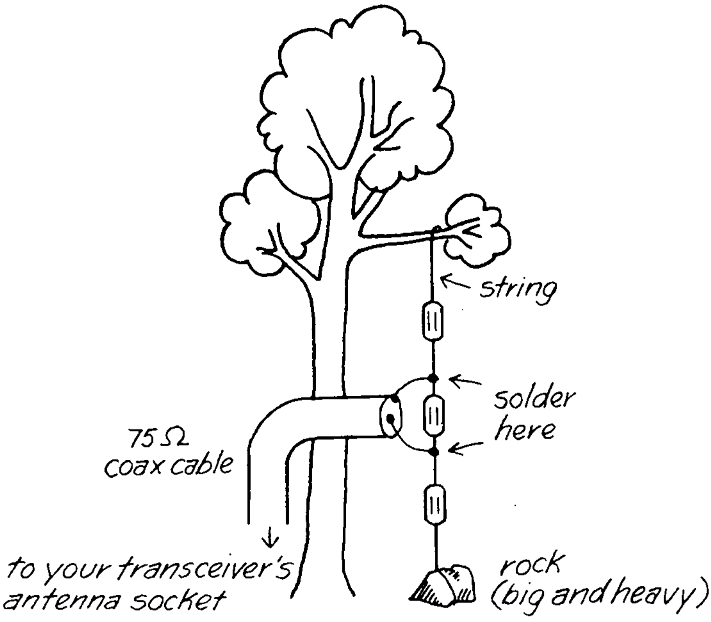


This dipole antenna is supported vertically

The next step is to connect the 75 ohm coax-cable to your dipole antenna. You will need a soldering iron for this job.


solder here
75 Ω coax cable goes into your antenna socket on your transceiver

The horizontal half wave dipole antenna



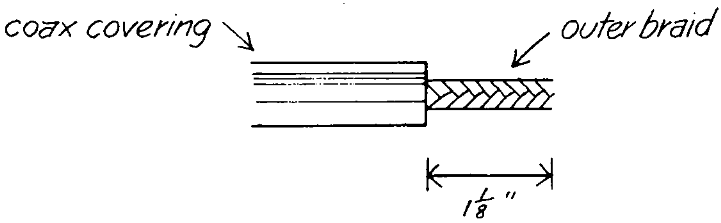
The vertical half wave dipole antenna

Now you are ready to wrap insulation tape around this antenna coax connection so that when it rains your coax won't get filled with water!

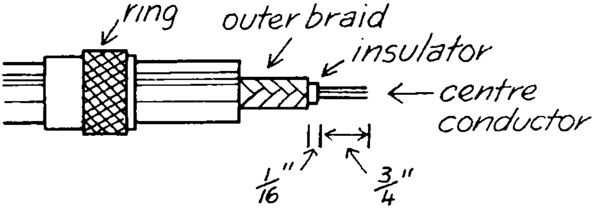
Finally, connect a plug onto the end of your coax leading to your transceiver. Most transceivers are fitted with a UHF type PL259 socket. You will need to buy a PL259 plug and solder it to your length of coax.

HOW TO SOLDER HALF INCH THICK COAX ONTO A PL259 PLUG

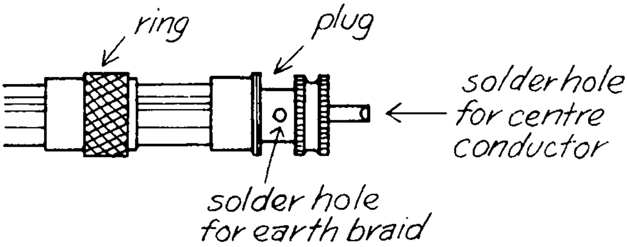
1. Remove 1⅛" of the rubber covering, leaving the outer braid of the coax exposed.



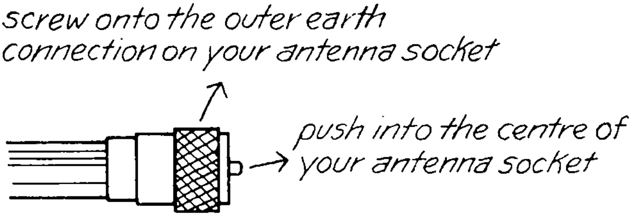
2. Remove ¾" of the outer braid and the insulator to expose the centre conductor, Remove a further 1/16" of the outer braid to expose the insulator.



3. Make sure the ring is in place, then screw on the plug tightly to the coax and solder the centre conductor and earth braid by applying solder and heat onto the solder holes.



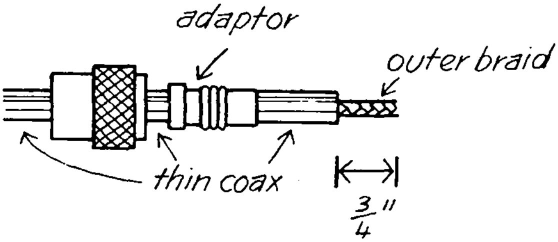
4. Check with a multi-meter that you have not accidentally connected the centre and earth conductors together.


screw onto the outer earth connection on your antenna socket
push into the centre of your antenna socket

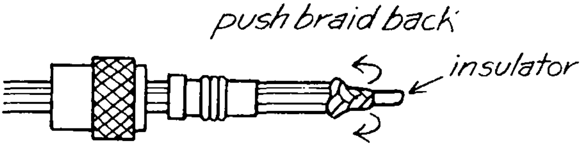
5. Screw the ring onto the plug.

HOW TO SOLDER THIN COAX WITH ADAPTORS ONTO PL259 PLUGS

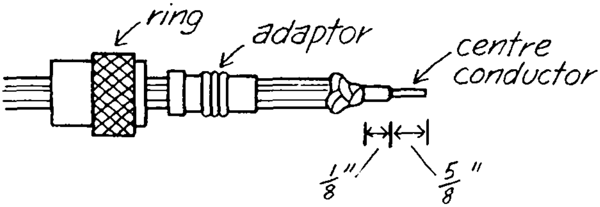
1. Remove ¾" of the rubber covering, leaving the outer braid of the coax exposed.



2. Push the earth braid back over the coax, then press the braid down flat.



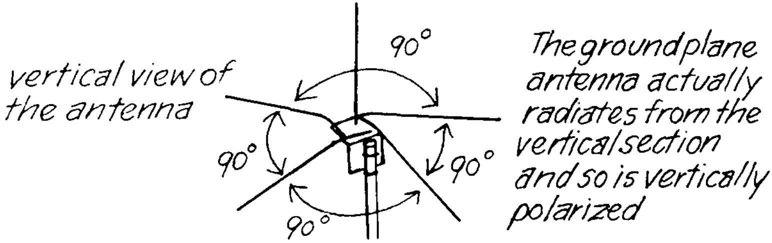
3. Press the braid down over the body of the adaptor. Remove ⅝" of the insulator to leave the centre conductor exposed.



4. Follow steps 3, 4 and 5 as for the half inch diameter coax.

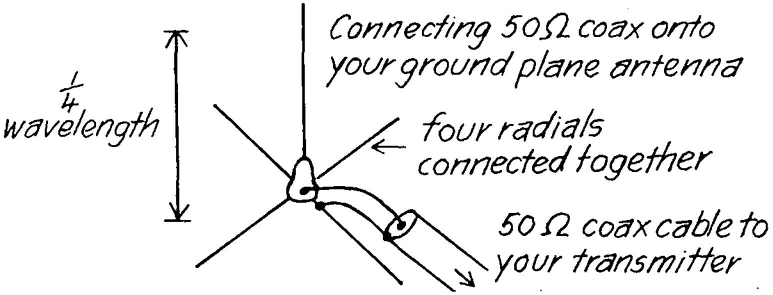
. . . Got all that straight? Now all you have to do is screw the plug into the transceiver, cross all your fingers and toes — and switch on!

QUARTER WAVE GROUND PLANE ANTENNA



The groundplane antenna actually radiates from the vertical section and so is vertically polarized

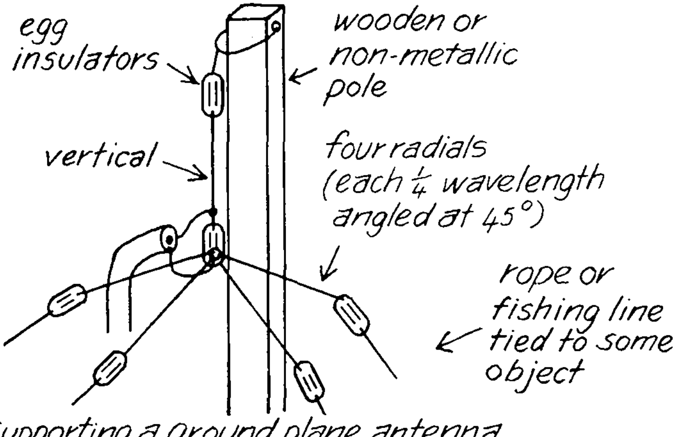
The ground plane antenna uses 50 ohm co-axial cable. The centre of the cable is connected to the vertical section and the earth braid outer conductor is connected to the four radials.


Connecting 50Ω coax onto your ground plane antenna

¼ wavelength
four radials connected together
50 Ω coax cable to your transmitter

The vertical and four ground planes are each a quarter of a wave length long. Use the table on page 120 to find the antenna length required for any band.

The whole antenna can be constructed by running a wire along the top of a wooden pole or any non-metallic support for the vertical section. The four ground plane wires are hung from a solder connection on the earth braid of the coax and are supported at a forty-five degree angle by fishing line or rope which is tied to some object on the ground.


egg insulators
wooden or non-metallic pole
vertical
four radials (each ¼ wavelength angled at 45°)
rope or fishing line tied to some object

Supporting a ground plane antenna

The vertical is held to the pole with a few knots of fishing line or rope and the 50 ohm co-axial cable runs down the pole.

MORE INFORMATION ON HOMEBREW ANTENNAS

Numerous books and magazines are available to help you make up your own antennas. The *ARRL Antenna Handbook*, *ABC's of Antennas*, *Wire Antennas for Radio Amateurs*, and the *Beam Antenna Handbook* are some of the favourites. The monthly WIA magazine *Amateur Radio* often contains very interesting construction articles for homebrew enthusiasts around Australia.

LENGTHS TO HELP YOU GET STARTED ON ANTENNA BREWING

BAND (metres)	**CENTRE FREQUENCY (Megahertz)**	**HALFWAVE LENGTH**		**QUARTERWAVE LENGTH**	
		(metres)	**(feet)**	**(metres)**	**(feet)**
160	1.825	78	256	39	128
80	Centre of novice band (3.550)	40.2	132	20.1	66
80	Centre of entire band (3.600)	39.6	130	19.8	65
40	7.075	20.1	66	10	33
20	14.175	10	33	5	16.5
15	Centre of novice band (21.162)	6.7	22	3.3	11
15	Centre of entire band (21.225)	6.7	22	3.3	11
10	Centre of novice band voice segment (28.450)	5	16.4	2.5	8.2
10	Centre of entire band (28.850)	4.9	16.2	2.5	8.1
6	52.5	2.7	8.9	1.3	4.4
2	146	0.97	3.2	0.48	1.6
70 cm	432	0.32	1.08	0.16	0.54
51 cm	579	0.24	.80	0.12	0.40
23 cm	1296	0.1	0.36	0.05	0.18
Microwave UHF and SHF bands	1296 to 24000	See previous reference to dish antennas on page 111			

SAFETY

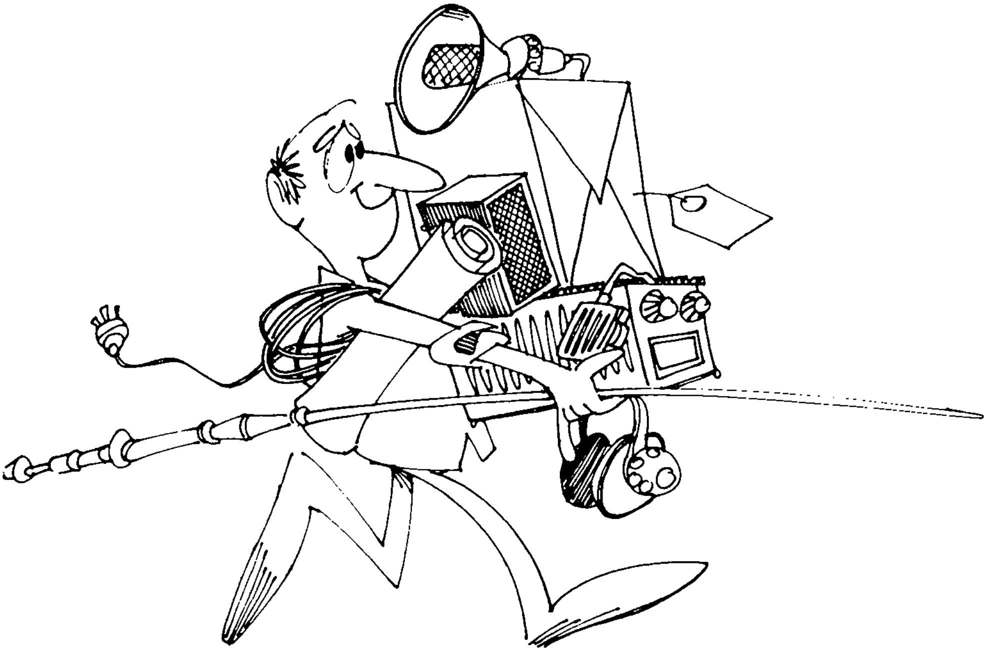
Never put up an antenna over or under power lines since contact with these would carry high voltage straight into your shack . . . destroying you and your equipment simultaneously.

Never use the earth pin in the 240 volt socket for your antennas or experiments — this could be extremely dangerous. When an earth is required always use the water tap or a metal pole hammered deep into the ground.

Chapter

10

Accessories for the Shack



Accessories for the Shack

MICROPHONES

There are numerous types of microphones available — but the most important factor in making the right choice is that the microphone must match your transmitter. So, check the transmitter manual (or, if you're homebrewing, the advice in the construction article) before buying a microphone.

There are two basically different types of mikes — VOX (voice operated switch) and PTT (push-to-talk).

VOX OR PTT?

VOX is a special circuit that activates the transmitter when you speak into the mike thus eliminating the need to activate the mike manually by pressing the 'push to talk' switch (PTT switch).

VOX is popular for home operation since it allows people to cut in on your conversation to tell you if they missed part of your transmission due to noise, interference from other stations or fading.

PTT operating is popular in both mobile and home stations. The main problem with PTT operation is that often two people can be talking to each other at the same time because of a misunderstanding (this is called doubling). The best way to prevent this is to let your button go every now and then just to make sure you are not transmitting on top of someone.

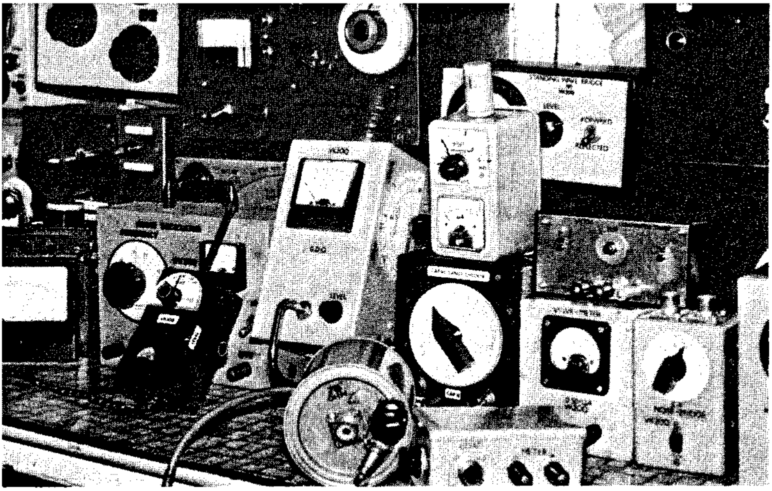
MICROPHONE COMPRESSOR

This unit can be connected between the microphone and the transmitter to help keep your voice level as it goes into the transmitter, no matter if you are shouting or speaking quietly. By doing this the compressor helps to keep your transmitter power output constant and high.

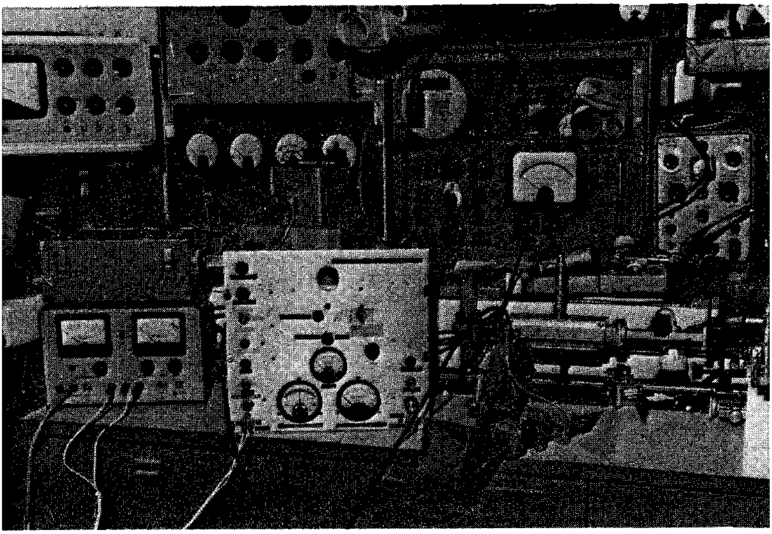
MORSE CODE KEYS

All sorts of different hand morse code keys are available for home use — some plastic, some bakelite and some metal base. All need to be screwed on to your table top or onto a heavy base.

Morse keys for mobile use can be strapped to your leg and you can drive down the main street tapping on your morse key. These mobile keys are sometimes available at disposal stores.



An assortment of amateur test equipment — all homebrewed.



A typical microwave test set up using a "slotted line" (a specialized form of SWR meter) for making measurements on microwave equipment.

ELECTRONIC KEYER

An electronic keyer will send perfect morse code dots and dashes. A vertically mounted paddle is moved from side to side to send out dots and dashes.

It's certainly a fun and easy way to send morse code but leave it until you have actually passed the morse exam using the good old hand key. You never know when you might have to use two pieces of metal, such as knife and fork, as a substitute for a morse key.

DUMMY LOAD?

When you are testing a transmitter or a new linear power amplifier, you should not test into an antenna since you are taking up air space and possibly interfering with others on the air. Instead, you connect a dummy load rather than your actual antenna which provides a suitable load for the transmitter without radiating a signal into the air.

Check that the dummy load you use can handle the power of your transmitter otherwise both the load and transmitter could be damaged.

POWER SUPPLIES

Additional power supplies for the shack are normally in the form of 12 volts for any transistorized equipment which does not have 240 volt facilities. Power supplies can normally be built up fairly easily from project articles in electronic magazines.

SWR AND POWER METER

The Standing Wave Ratio Meter and its importance was explained in detail in Chapter 9, ANTENNAS.

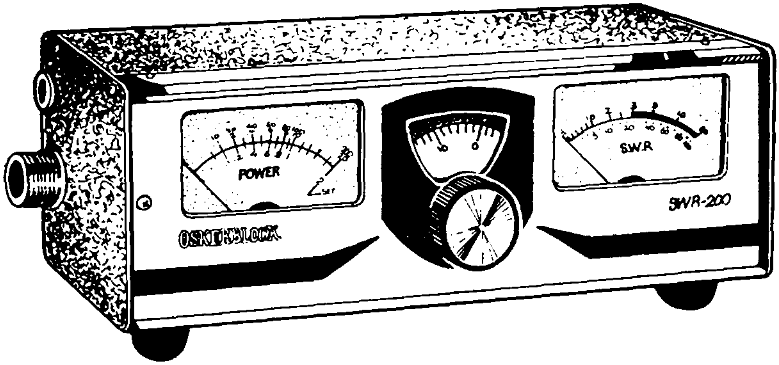
SWR meters often have an extra function in the form of a power output scale. If not, then you can buy what is called a Power Output Meter.

Some meters only measure power up to 10 watts, others go up to 100 watts, 2000 watts or more.

This power output indicator is used when you want to adjust a transmitter for a maximum of power output into the antenna or dummy load.

To adjust a high power transmitter using an SWR meter all you need to do is put your meter in the SWR forward position and set the meter near centre scale. Now you can adjust your transmitter to maximum power output by using this relative power indication. Always tune your antenna initially at low levels, otherwise you might damage it.

Power is measured in watts — 1 kilowatt = 1000 watts
— 1 watt = 1000 milliwatts



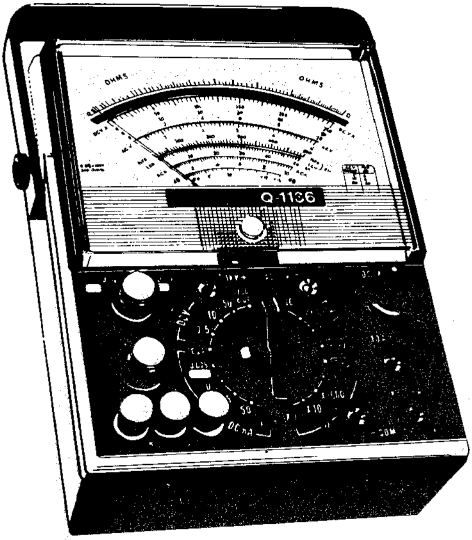
A high quality in-line SWR meter.

MULTI-METER

The multi-meter is the second piece of test equipment most commonly found in the amateur's radio shack. A multi-meter measures electrical current, voltage and resistance. Current is measured in amperes (or amps)

— 1 ampere = 1000 milliamps (mA)
— 1 milliamp = 1000 microamps (uA)

The multimeter allows you to measure different amounts of current so that you can see how many amps or milliamps or microamps are flowing through a wire.



An excellent multirange test meter including a transistor checker.

FIELD STRENGTH METER

This meter is sometimes built into an SWR meter as an extra function.

This meter is used to adjust an antenna for maximum radiated power.

Voltages (both alternating and direct) should be measured to make sure they are correct.

SIGNAL GENERATOR

The signal generator is like a little transmitter which provides you with a constant signal on any chosen frequency.

This instrument is used to help you tune up or align equipment such as receivers once you have finished constructing them.

Signal generators normally cover only certain ranges of frequencies such as the LF, MF, HF and part of the VHF range. However, generators for the VLF, UHF and SHF bands can also be obtained.

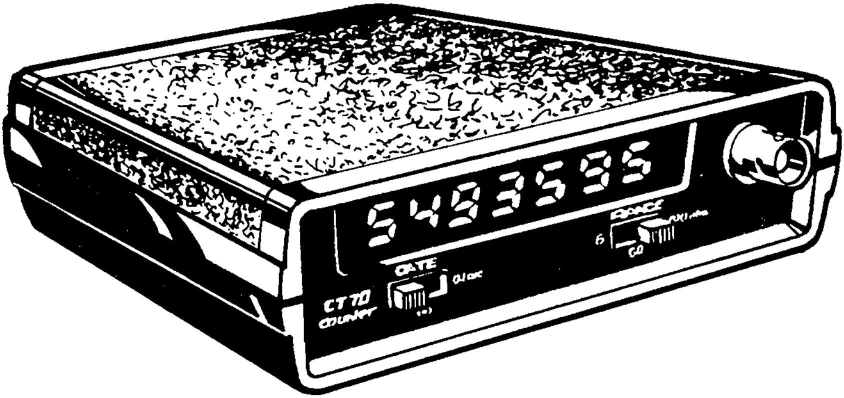
The dial on a signal generator is in frequencies marked in either Kilohertz or Megahertz.

FREQUENCY METER/COUNTER

A frequency meter or counter is used to tell you the exact frequency on which your receiver or transmitter is operating.

Meters show this frequency numerically displayed on a dial.

Frequencies are usually in the LF, MF, HF and part of the VHF range. Counters for VLF, UHF and SHF are also available.



A 600 MHz frequency counter.

GRID DIP OSCILLATOR

A grid dip oscillator (GDO) or a transistorised base dip oscillator can be used to tell you approximately to what frequency your antenna is tuned and approximately to what frequency a tuned circuit is tuned. (The tuned circuit is that part of a receiver or transmitter consisting of a capacitor connected to a coil.)

The frequency on which a tuned circuit or an antenna is designed to operate is known as the *resonant frequency*. It's this resonant frequency which the GDO measures.

OSCILLOSCOPE

An oscilloscope allows you to see your radio voltage and currents in the form of an electrical diagram projected onto the face of the instrument.

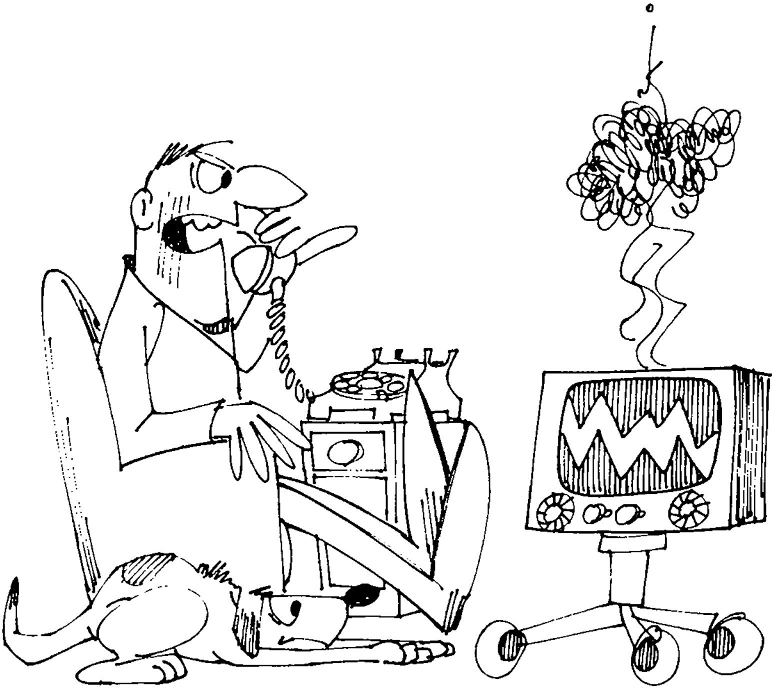
This is a fairly sophisticated piece of equipment and usually left as one of the final additions to the shack.

OTHER ACCESSORIES?

This chapter is only meant as a general guide to basic accessories. Of course, there are many, many more. As you become increasingly involved in amateur radio you will become more knowledgeable about what is available and how this or that gadget could liven up your shack.

Chapter 11

How to Solve Interference Problems



How to Solve Interference Problems

Every amateur is encouraged to take a responsible attitude to interference problems — your fantastic radio shack set-up might be playing merry hell with normal electrical equipment in nearby houses.

When you have set up your station, tell your neighbours about it and invite them to tell you about any interference problems which may occur. This friendly initiative on your part goes a long way in preventing neighbourhood hostility if your rig does cause trouble.

If your neighbour has an interference problem, offer to help him with it — after all you probably know a lot more about electronics than he does.

If you are unlucky enough to have a particularly unco-operative neighbour you are within your rights to ask the Postal and Telecommunications Department to send out an inspector. If the inspector finds your equipment at fault then you must stay off the air till you fix the problem. If your neighbour's TV set is at fault, then it's just normal courtesy to offer assistance in rectifying the problem.

(Actually, I'm in a bit of strife myself right now. Something in my shack is wreaking havoc with the next door fellow's stereo. I intend to solve this problem fast – I've just got to make contact with Hoboken, New Jersey, to find out what's happened to Boris.)

TYPES OF TELEVISION INTERFERENCE

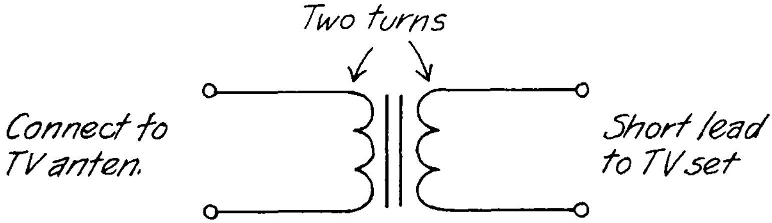
- *Interference to the picture on all channels*

This problem could be caused by your signal getting into your neighbour's TV through his TV antenna simply because your transmitting antenna is so close. (It's called front end overload). You could try an isolation transformer to help solve this problem.

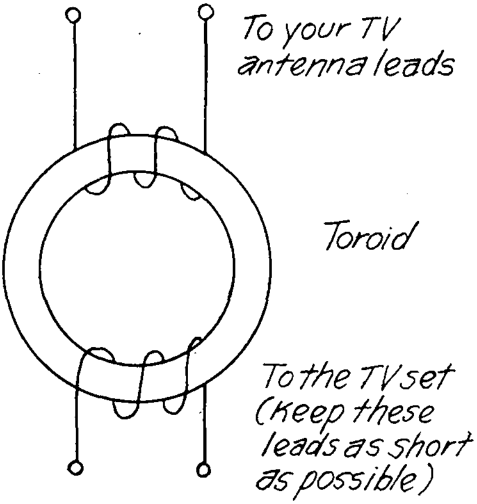
Simply obtain any torroid or balun core from your radio store and wind a pair of two turn coils on this circular core. If you make the two wires of different colour it will help you identify which coil is which. Connect the two similar wires to the TV antenna co-axial cable and the other two similar wires to the TV set.

A high pass filter, obtainable from any electronic dealer, may also be useful but try the isolation transformer first.

WARNING: THERE ARE DANGEROUS VOLTAGES AT THE BACK OF THE TV SET. WHENEVER YOU WORK WITH 240 VOLTS ALWAYS TURN THE SET OFF *AND* PULL THE 240 PLUG OUT OF THE SOCKET.



This isolation transformer lets your TV signals pass but blocks your HF and MF signals



Try shortening or moving the position of the ribbon cable between the neighbour's TV and his antenna.

- *Interference to the picture on only one channel*

This could be the fault of your transmitter, so you should try connecting a low pass filter between your transmitter and your transmitting antenna.

- *Sound interference on all channels*

If your neighbour is hearing someone's voice, the problem could be caused by your signal being received either by the TV antenna, the 240 volt plug or directly into the set. This is called audio interference, so try some of the ideas in the stereo section below.

Try a disc 20 pf capacitor across the TV terminals — capacitors are used to by-pass radio frequency interference.

- *Interference to stereo, public address and telephone*

Attempt to find out at what part of the equipment the interference is entering — e.g. is it getting through the speaker leads or the 240 volt power leads?

Try the following methods and if the interference decreases you're on the right track.

1. Put shielded cable on the speaker leads.
2. Connect a 100 pf disc ceramic capacitor across the speaker leads.
3. Connect an AC line filter between the 240 volt socket and plug if you suspect the signal is getting in by way of the power point.

OTHER SOLUTIONS

- *Use other frequencies or bands*

Try other bands and see if you can avoid the interference.

(Using an isolation transformer and dropping as far away from the TV frequencies as possible, a friend of mine found he could run 400 watts on 160 metres without any trace of TV interference yet he couldn't use 80 metres even on 5 watts.)

Try all the bands you have and find out which ones you can use without causing a problem. Learn when your neighbour turns the TV or the stereo on and off and time your operation on the different bands accordingly.

Use of VHF, UHF and SHF bands often prove a good way to escape from interference problems.

- *Decrease transmitter power output*

Running 400 watts on 10 metres sure can get into stereo and TV sets but if you drop down to 12 watts you can still work the world and enjoy life on 10 metres.

(I know someone who has worked 180 countries on 20 and 80 metres using only 1 watt on SSB! And would you believe working on 10 metre all over Australia on just 2 watts of AM? See page 136 for more about low power, or QRP, operating.)

- *Increase antenna height*

Before you do this check with your local council — generally they will let you put up a fairly high tower as long as it is only for amateur hobby use. That's another reason to be friendly with your neighbours — it's all the better if they don't object to your proposed mast.

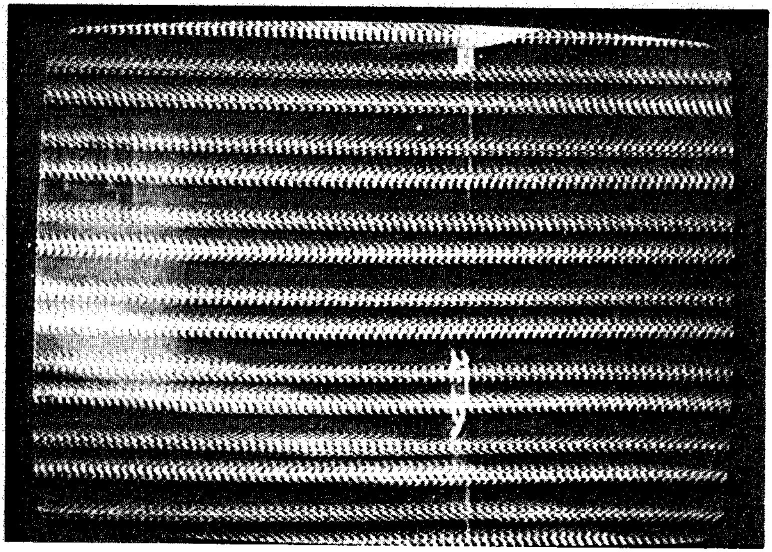
(Looking on the bright side of the interference problem – it's a great way to meet the neighbours and make new friends. Only a few weeks ago a mate of mine asked three of his close neighbours to support his application to put up an 80 foot tower with a lovely beam antenna on the top of it – they did, and now even the local council has approved it!)

The moral is, get to meet your neighbours — invite them into your shack and be willing to be co-operative when help is asked of you.

- *Change antenna position*

Move the location of your radio antenna or your neighbour's TV antenna — or both.

Change the direction of your dipole antenna. Point it away from and, if possible, end on to your neighbour's TV antenna. Drop the height of the



A typical example of television interference.

No wonder your neighbours get upset when this happens in the middle of the Sunday night movie.

TV antenna or raise it. See if the changed position decreases the interference.

- *Try a different type of antenna*

Change to another polarization. If you've got a horizontal dipole try a vertical — or vice versa.

Put up a rotatable beam antenna and turn the aerial side on to the building where the interference is occurring.

If the dipole does not have a balun, connect one — since the coax could be radiating and causing the problem.

Locate your dipole close to the ground so the radio waves radiate directly upwards instead of passing through nearby buildings. This type of antenna set up works very well on 160, 80 and 40 metres.

A vertical ground plane as high in the air as possible could help to get the signal *over* the nearby houses instead of *through* them and so eliminate interference. This type of antenna works well on 20, 15 and 10 metres.

- *Go portable or handheld*

That's right — if all fails and you give up why not cart your gear down to the local park, string up an antenna or two and work the world as you watch the locals having their game of footy.

- *More information*

The *ARRL Radio Amateur's Handbook* has a very informative chapter on interference.

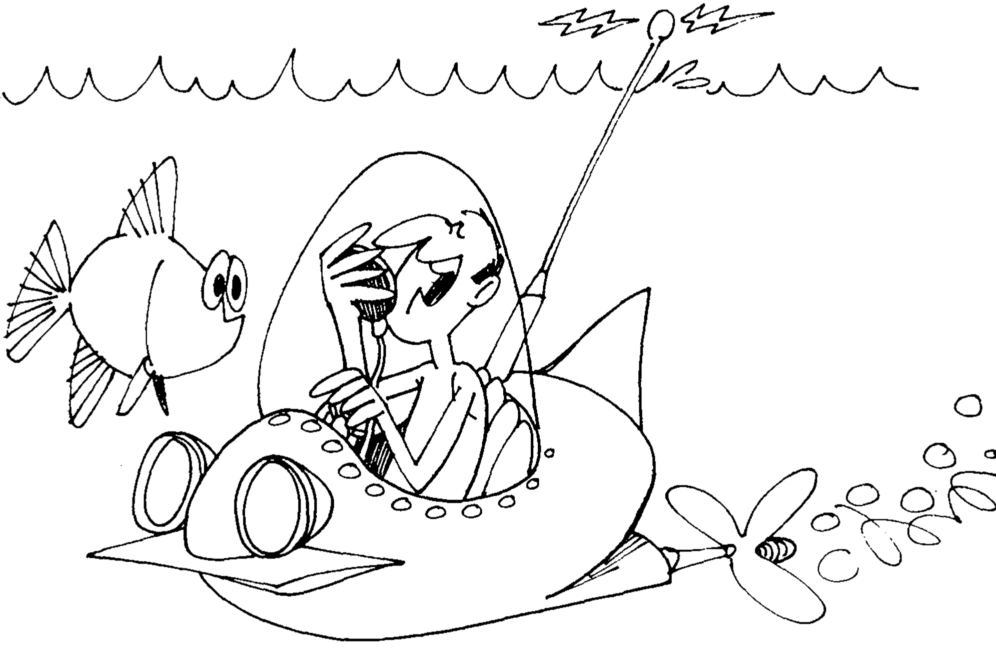
- *The final solution*

Move house!

Chapter

12

Operating Procedures for Exploring the Airwaves



Operating Procedures for Exploring the Airwaves

In the Amateur Radio world, just as in the everyday world, there is usually a right and a wrong way to do things. The purpose of this chapter is to explain the various correct procedures (some of them are just plain courtesy or etiquette) used in amateur operating. If you follow these procedures you'll make life a lot easier for yourself and your fellow operators.

(The nitty gritty has already been covered in Chapter 6, GETTING STARTED ON THE AIRWAVES, but as I said way back then, there is a whole lot more to it.)

Let's begin with DXing — one of the most fascinating aspects of amateur radio.

MOBILE DXING

If you're mobile, tell the world where you are — in a car, on a mountain top or at your local park, in a plane, in a boat or walking along the roadside. There could be something special about your location which would attract the DX listener.

AM DXING

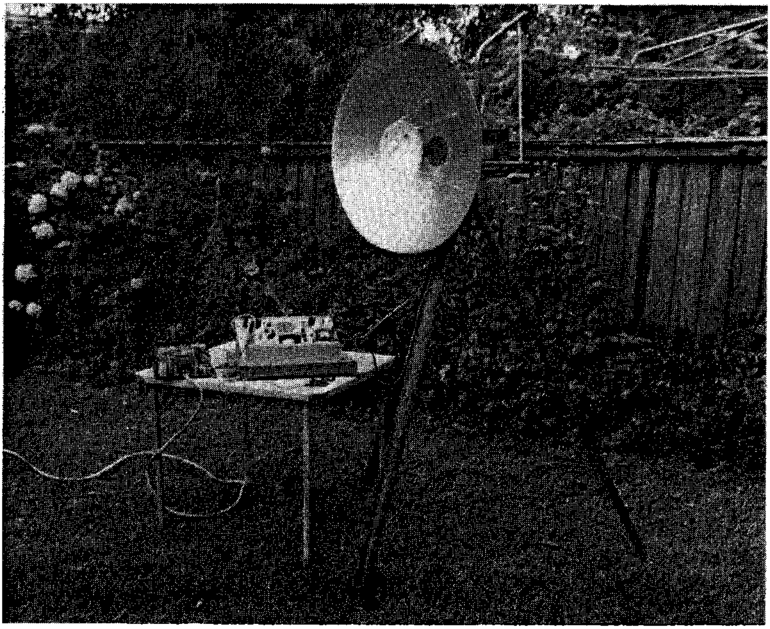
Easy to build and inexpensive to buy, AM equipment can be a challenging way of operating over long distances.

The main operating technique is to select a frequency which is clear of any stations. Tune 3 KHz above your frequency and 3 KHz below your frequency — if you can't hear anything ask, ''Is this frequency clear? Is this frequency occupied?'' If there is no reply, then the frequency is all yours.

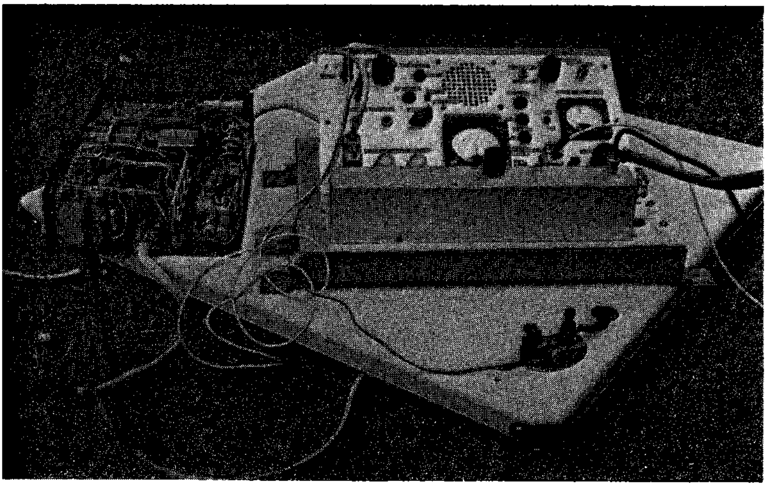
Worldwide low power AM contacts are quite a nice challenge on 10 metres using modified CB transceivers. On 160, 80 and 40 metres, homemade AM gear provides good Australia-wide coverage.

VHF AND UHF DXING

When you establish a contact on a calling frequency (and this also applies to MF and HF operating), you should change to another frequency to continue your contact. This leaves particular calling frequencies free for others to establish their contacts.



A complete microwave transmitter suitable for portable operation. In fact this unit has been operated from many a mountain for the purpose of establishing microwave DX records.



A close-up view of the microwave equipment showing morse key and power supply (left) and the transmitter (centre).

SHF DXING

People often arrange schedules to meet on the air at a certain time and on a certain frequency. It is fun to choose two locations spaced over interesting terrain.

(When flooding occurred in the interior of Australia's desert, creating the humidity duct phenomenon (see page 95), hordes of SHF fanatics experienced fascinating contacts during this once-in-a-lifetime occurrence.)

To prearrange SHF DX attempts you could first establish contact by using one of the more reliable lower frequencies. Once contact is made you can then easily co-ordinate your SHF DX attempt.

On 10,000 MHz, many people in Europe have made contacts with other countries without links of any kind — just by calling CQ. This is especially popular at times when the weather map contours have remained stable for days on end. On these occasions microwave DX'ers across the countryside go on the lookout for distant signals.

DXING ON QRP

QRP is lower power operating. Many people get a great kick out of building up a little inexpensive transmitter and trying to make worldwide contacts using very low power sets which are often small enough to fit into your top shirt pocket.

The antenna is the most important part of the QRP station. A good dipole or ground plane will get your ½ or 1 watt signal around the world if you follow good operating techniques.

Twenty five watts or less is regarded as QRP (low power) and under five watts is regarded as QRPP (very low power).

QRPP operators generally operate 60 KHz above the lower edge of each band, e.g. 14060 KHz. The secret is to find a clear frequency and start calling — or find someone and give them a call.

When you call, tell the world how many watts you are using. For example, the fact that you are only using one watt could attract people who would normally not reply.

The call would be like this:

"CQ CQ CQ de VK4AA/QRP $\overline{\text{AR}}$ K " or on voice, "CQ CQ CQ this is VK4AA running 1 watt QRP calling CQ and listening."

Put out the call for about a minute — then listen. If there's no reply, try again.

Some QRPP operators use a tape recorder to put out short CQ calls with frequent pauses to allow for replies. While the tape recorder is at work you are free to get on with your current homebrew project until you get a reply.

To send morse code CQ calls you connect the tape recorder to a relay which turns the transmitter on and off as the pre-recorded dots and dashes are played. Since the transmitter should operate "break in" — this is quite a good system.

On voice, you simply get the transmitter to operate VOX, put the recorder near the microphone and away you go.

OPERATING ON A PILE UP

When a rare station comes on the airwaves from some exotic seldom-heard-from part of the world — the chances are that a lot of people will want to make contact. The result of everyone calling the same station at the same time on the same frequency is termed a 'pile up'.

Listen carefully to how the DX station is sorting out all the signals. Is he picking out the stations who are calling right at the end of the 'pile up' when the interference has died down? Or is he picking up the stations calling slightly off his frequency? Use this information to time your call so that the DX station will pick you up.

Only give short calls — you might find that the rare station has made a contact and that by calling him you are interfering with the station he has selected.

When you have made contact, announce the station's call sign just once and get straight into the contact. Remember, others are waiting their turn to talk with the rare one.

DX GUIDE FOR VOICE AND MORSE CODE

1. Call distant stations only when they have sent a CQ (meaning a general call to any station), QRZ? (meaning who is calling me) or SK (meaning 'go ahead any other station listening').
2. *Do not call* a distant station until:
   - you are sure a *previous* contact has been complete.
   - The person sends KN (meaning 'go ahead only the station I have called').
   - or the person sends $\overline{\text{AR}}$ (meaning 'I am calling a specific station only').
   - or the person sends CL (meaning 'I am closing down my station').
   - or after a directional CQ call unless you are in the right area.
3. Remember, on the MF and HF, do not answer a CQ DX call if you are in the country of the calling station. On VHF, UHF, SHF do not answer a CQ DX call if you are within 300 kilometres from the calling station.
4. Give true signal reports as defined in the RST code.
5. Give everyone a fair go — especially the person not operating from home, the person using low power and the newcomer to the air-waves.
6. Show consideration, helpfulness and responsibility in the way you conduct yourself on air.

REPEATER OPERATING PROCEDURES

You will remember that each repeater also has what is called a 'time out' period. In other words, if you talk continuously for, say, three minutes, the repeater will switch itself off automatically and cut you off.

Good operating procedures include:

1. Listen in to the repeater in your area before you use it — get to understand the procedures used.
2. Do not press your transmit button just to see if the repeater is operating. Always identify your station if you want to see if you can get into the repeater, e.g. "VK2AA testing."

   (Mysterious button pushers really bug me when I'm listening for calls and doing some work around the shack at the same time.)
3. Because large numbers of people are usually listening on the repeaters, your CQ call should be very brief, e.g. "CQ VK2AA calling CQ and listening."
4. Always pause three seconds before it's your turn to transmit — this allows the repeater's 'timer' to reset and it also allows other people to break in.
5. Try not to use a repeater if you can talk to someone directly. Repeaters are for the benefit of mobiles and stations out of range. When you establish contact, try and change to another frequency to continue the contact. If you can't get through, then you can always return to the repeater.
6. Keep your transmissions short — repeaters are in great demand, try not to exceed a minute on a single over. Use a direct frequency if you want to talk for a long time.
7. Don't interrupt a conversation unless you have a reason for doing so. To join in a conversation on a repeater, you do not use the word 'break' but you simply give your call sign, e.g. "VK7AA" — you say this in the pause between one station turning the microphone over to another. Never transmit on top of another station.Once you have identified yourself, wait until you are called into the group.

   "Break, break, this is VK7AA" means you have an urgent message and request to be called into the group immediately. In an emergency, simply say "Emergency, this is VK7AA".
8. If you want to call a person on the repeater but the repeater is occupied, it is courteous to ask if you could use the repeater. If you make your contact, pass your message quickly or change to another frequency. Return the repeater to those who were using it before as quickly as possible.
9. When you operate on bands where repeater operating is permitted, be careful not to operate on the input frequency of repeaters for normal direct frequency contacts. Australian repeaters are currently operating on the 2 metre and 70 centimetre bands.
10. Support the local group who are maintaining your repeater. Help and co-operate when such a group requests your assistance.
11. Take time to explain the ins and outs of repeater operating to the newcomer.

AMATEUR SATELLITES

You'll probably remember that amateur communications satellites receive your signals on one band and retransmit them on another. (If you have to jolt your memory turn back to page 38.)

There are three types of satellite modes or operating frequencies. These modes vary with the different satellites and can be activated by Amateur Command ground stations. The regular WIA Sunday broadcast (for time and frequency details see Chapter 7) gives the estimated times the satellites will be operating and the modes which will be in use.

OSCAR 7

Mode A operation involves receiving on the 10 metre band and transmitting on 2 metres.

You transmit between 145.85 to 145.95 MHz. You receive the satellite retransmission between 29.4 to 29.5 MHz.

When mode A is operating the satellite's 10 metre beacon can be heard on 29.502 MHz.

Mode A is linearly transmitted. This means that if you transmit on the low end of the frequency you will be retransmitted on the low end of the frequency. For example, if you transmit on 145.85 MHz your signal will be retransmitted on 29.4 MHz.

Mode B operation involves receiving on 2 metres and transmitting on 70 centimetres.

You transmit between 432.125 to 432.175 MHz.

You receive between 145.925 to 145.975 MHz.

When mode B is operating the satellite's 2 metre beacon can be heard on 145.972 MHz.

Oscar 7 also has beacons operating on UHF band 435.1 MHz and 2304.1 MHz.

Mode B is inverted in the retransmission. This means that if you transmit on the low end of the frequency you will be retransmitted on the high end of the frequency. For example, if you transmit on 432.125 MHz your signal will be retransmitted onto 145.975 MHz and *not* 145.925 MHz. This means that USB will be retransmitted as LSB, and vice versa.

OSCAR 8

Mode A

Transmit between 145.85 to 145.95 MHz.

Receive between 29.4 to 29.5 MHz.

When Mode A is operating the satellite's 10 metre beacon can be heard on 29.402 MHz.

Retransmission is linear.

Mode J

Transmit between 145.90 to 146 MHz.

Receive between 432.10 to 432.2 MHz.

When Mode J is operating the satellite's 70 centimetre beacon can be heard on 435.09 MHz.

Retransmission is inverted.

RUSSIAN SATELLITES

Mode A

Transmit between 145.80 to 145.90 MHz.

Receive between 29.3 to 29.4 MHz.

SATELLITE OPERATING PROCEDURES

1. Ascertaining the location of satellites is reasonably involved. However certain information is available to aid the amateur. This involves the use of:
    - standard prediction tables (printed in the WIA's *Amateur Radio* each month) and either
    - the standard orbital tables for each satellite (for further information on the availability and use of these contact your local WIA) or
    - a satellite tracking plotter which provides an immediate visual display of the satellites' path available from certain good electronic stores.
2. Make your call short — lots of people are trying to make contacts within the twenty-five minutes or less during which the satellite is within range.
3. Don't worry if you have to retune your receiver while you pick up yourself and others through the satellite. The satellite is actually shifting your frequency slightly because it's moving at 15,000 miles per hour through space. It's a phenomenon called Doppler Frequency Shift.
4. Keep your power output below 100 watts. Excessive power doesn't improve your signals out of the satellite but only makes the satellite draw more current out of its batteries, thereby shortening the life of the satellite.

    For satellite operating a power level of about 50 watts into a non-directional antenna is sufficient. You would only need 10 watts with a directional antenna aimed at the satellite.

EARTH-MOON-EARTH (EME) OPERATING PROCEDURES

Australian amateurs operating with dish antennas using a power of 150 watts on morse code and 250 watts on SSB have been able to establish overseas contacts by reflecting their signals off the moon.

The most popular EME bands are the 2 metre, 70cm, 23cm and 13cm.

To operate EME your equipment must have high frequency accuracy, high power, the largest possible antenna and an ultra sensitive receiver.

Special permits to use 1000 watts or more can be obtained by amateurs keen on moon communicating.

To organise schedules with EME enthusiasts around the world you must *select a time* when the moon is in the best possible position in the sky for optimum transmission.

The points to remember are:

- the moon must be as close as possible to the earth.
- the moon should not be near the sun during daytime contacts — the sun gives out interfering noise.
- the moon should be as far away as possible from constellations such as Orion, Gemini, Scorpius or Sagittarius — they also give out radio noise.
- avoid southern areas where galactic noise emanates from out of our own galaxy, the Milky Way.

Using tables and charts (found in the ARRL publication *Specialised Communicatons Techniques for the Radio Amateur* available from electronic stores) you can determine information which will pinpoint your "EME window" in the sky.

In EME a different signal strength reporting method is used.

This is because of:

- the distance the signal has to travel — 225,000 miles and back
- the polarization of the signal is changed as it goes through the ionosphere
- the fading of the returning signals due to their reflection off the uneven surface of the moon.

2 METRE EME SIGNAL REPORTS

T — your signal is just detectable
M — I can only copy portions of your call sign
O — I can hear your whole call sign
R — I have received you sending both mine and your call signs
SK — End of contact

EME SCHEDULES

You can pre-arrange times to contact someone on a certain frequency. At the given time both stations call each other, using the following procedure, until contact is made.

On the 2 metre band the standard procedure is to organise alternating 1½ minute periods during which one person transmits and the other receives, e.g. the amateur in the USA may be scheduled to transmit on the first 1½ minute period (called the odd period) and the amateur in Australia is scheduled to transmit on the second 1½ minute period (called the even period.)

It would work like this:

Period	*1½ minutes*
1	VK2AA de VK6AA
2	VK6AA de VK2AA TTTT
3	VK2AA de VK6AA OOOO
4	RO RO RO RO de VK2AA K
5	R R R R de VK6AA K
6	Q R Z? EME de VK2AA

In the above example VK6AA is calling VK2AA.

VK2AA hears VK6AA and sends a report of T

VK6AA hears VK2AA and sends a report of O

VK2AA hears VK6AA's report and sends RO (confirming reception)

VK6AA hears VK2AA's transmission and sends R

VK2AA concludes the contact by inviting any other stations who would like to try for an EME contact.

70 CENTIMETRES EME SIGNAL REPORTS

T — portions of calls copied
M — complete call copied
O — good signals — better than average copy
5 — excellent signal (possibly good enough for SSB voice)
R — call signs and signal report received
SK — end of contact

On a 70cm schedule, instead of a 1½ minute sequence, the sequence is increased to 2½ minutes so that more time is available to repeat details ensuring reception between EME operators. Of course these time lengths can be varied by arrangement prior to a schedule.

For EME working in Morse Code speeds of between 5 to 10 words per minute have been found to give the best readable results.

METEOR SCATTER OPERATING PROCEDURES

This term describes contacts made by bouncing signals off meteor trails. The 6 and 2 metre bands are the most popular for this type of transmission. As in EME your equipment should be capable of accurate frequency settings.

Meteors burn up in the atmosphere throughout the year and are known as "meteor showers". Major yearly meteor showers occur as the earth passes through well known meteor belts as it orbits around the sun.

Information listing dates and times of meteor showers occurring throughout the year is available in Australian astronomical magazines. These details should help you aim your antenna at the right spot in the sky.

During these predictable showers schedules can be arranged to contact people at a certain time and frequency.

Operating consists of one station calling for the first 5 minutes of a pre-arranged time and the other listening. During the next 5 minutes turns are reversed.

You can identify by saying, "This is VK8AA" but do not use phonetics since each second is valuable in meteor scatter — those meteors move fast!

The most widely used signal reporting system is the TMOR as used in EME on 70 centimetres.

SSB voice and morse are popular modes of transmission for meteor communicating.

AMATEUR TELEVISION OPERATING PROCEDURE

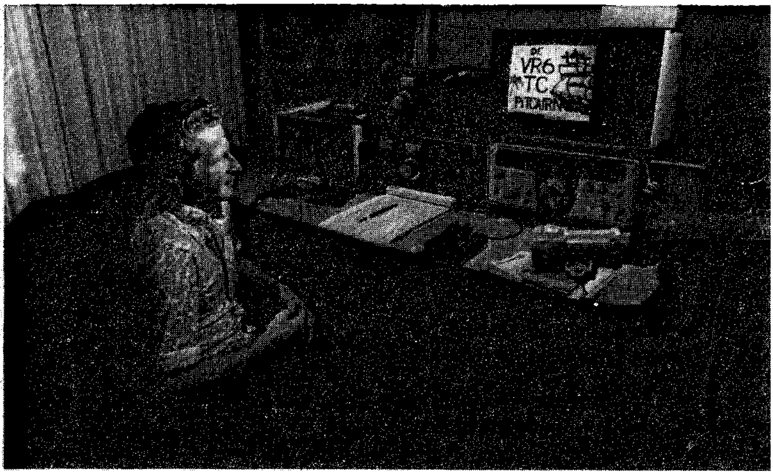
Full colour or black and white live television can be sent by putting the picture on the 432 MHz band and the voice on the 144 MHz band. You can even use the amateur TV repeaters to boost yourself over a large area.

Your call sign should appear on camera. Also, you can display the frequency on which you are listening so that if anyone receives you they can put their ATV signal on your listening frequency and wave hello!

(I've finally sorted out my interference problems and I'm back on the air – with incredible results! I've just picked up a picture of Boris. But he didn't look too happy. No wonder – he's got problems. The CIA is sending him to Antarctica to infiltrate the Russian base!)

SLOW SCAN TELEVISION OPERATING PROCEDURES

SSTV is used on all bands but is particularly popular on the HF bands for overseas contacts.



A good example of an SSTV picture during actual reception.

No prizes for guessing the source of this transmission.

To establish a contact transmit in picture form the words "CQ, CQ de (call sign)". It might be more interesting if you transmitted a photograph depicting your local area with the wording superimposed on the photograph. For instance, say you are in Australian Antarctica, a nice shot of the local glacier with the words "CQ, CQ de VK0AA" could be quite impressive.

Transmit continuously for, say, two minutes — then listen for any replies. If you want to receive replies on a different frequency to the one on which you are transmitting include this information on your picture, e.g. "Listening on 14.230 MHz".

Simultaneous photos and voice comments can be sent on separate frequencies — however, it is common to send a photo, then say a few words on the same frequency and then send another photo.

RADIO TELETYPE OPERATING PROCEDURE

Radio teletype operates similarly to a typewriter — as a page is typed, the carriage moves across until you come to the end of the line. It is then necessary to press the carriage return button so that you're ready to type on the far left hand side of the page and it's also necessary to press the "linefeed button" so as to advance the page onto the next line.

To call CQ on radio teletype you type out, "(2CR) (LF) CQ CQ CQ de VK9AA VK9AA K (CR) (LF)"

CR stands for carriage return and LF for line feed.

If you have a special machine (called a perforator) attached to your teleprinter, pre-typed messages can be fed into it for transmission at a time that suits you. The WIA prepares their RTTY broadcasts in this manner.

AMATEUR EMERGENCY OPERATING PROCEDURE

MORSE CODE DISTRESS PROCEDURE

The letters SOS (···------···) sent in morse code three times, followed by the word "de" meaning "this is", followed by the call sign of the station in distress sent three times INDICATES THAT THE CALLING STATION IS IN IMMEDIATE AND GRAVE DANGER.

MORSE CODE URGENCY PROCEDURE

The letters XXX (-··--··--··-) sent in morse code in place of SOS means that the calling station has a very urgent message to transmit concerning the safety of a ship, aircraft or a person.

VOICE DISTRESS PROCEDURE

The word "MAYDAY" spoken three times followed by the word "THIS IS" followed by the call sign of the station in distress INDICATES THAT THE CALLING STATION IS IN IMMEDIATE AND GRAVE DANGER.

VOICE URGENCY PROCEDURE

The word "PAN" spoken in place of "MAYDAY" means that the calling station has a very urgent message to transmit concerning safety.

EMERGENCY PROCEDURES

If you hear a distress or urgency call — immediately stop transmitting and listen.

Provided you are sure that your transmission will not interfere with other stations handling the distress message, answer the call.

Use any means you can to pass on details of the distress or urgency message to the Police, the nearest Official Coast Station or any authority able to render assistance.

Once you have done this resume listening on the distress frequency and keep the appropriate authority informed of developments.

OTHER POINTS TO REMEMBER

- After a distress or urgency call the exact location and nature of the problem are often transmitted without waiting for a reply so be prepared to write down all details in case transmission suddenly ceases.

- If you receive a distress and an urgency call at the same time, you must give the distress call priority.
- Ships normally send morse code distress calls on 500 KHz and voice distress calls on 2182 KHz and 6280 KHz. Some survival craft use 8364 KHz.
- After failing to raise a response on their own frequency, any person on a ship, plane, in space, on land, etc. can, if he has those frequencies available, transmit on the amateur bands or any other bands where assistance can be obtained.
- You could find yourself coping with an emergency situation at any time. Use your common sense in handling each situation as it arises.

(Talking of emergencies – I can't locate Boris. The only ATV contact I made in Hoboken was with a blonde bird who kept bursting into tears. Is Boris on the job again? Guess I'll have to put out a UA1 call.)

Chapter

13

Popular Amateur Activities

Popular Amateur Activities

ON AIR RADIO CONTESTS

In a real emergency, just how long would you and your equipment last? You'd feel rather stupid, to say the least, if smoke started to pour out of your set after only a few hours on the air. And what about the operator — you. How long could you go without sleep in an emergency when messages from all over the world are pouring into your station, hour after hour?

To sharpen your operating skills and help keep your station in readiness — all sorts of radio on air activities, in the form of contests, are organised. There are many different contests throughout the year, usually held on weekends. Contests are a lot of fun, each one has different objectives, for example:

- emergency practice.
- to work as many stations as you can.
- to contact people in a certain part of the world.
- To work with as little power as possible.

The winners receive handsome award certificates.

SOME MAJOR CONTESTS

Name	Date	Activity
10 metre Worldwide DX Contest	2nd weekend in December	10 Metre DXing
Australian Novice Contest	2nd weekend in December	All novice bands contest
160 Metre Worldwide DX Contest	December and January	160 Metre DXing
Ross Hall Australian VHF/UHF/SHF Contest	December to January	DXing from VHF to SHF
John Moyle National Field Day	2nd weekend in February	Portable operating on all bands
ARRL International DX Contest	March — 1st weekend March — 3rd weekend	Voice operating Morse operating
Armed Forces Day Communications Test	3rd weekend in May	Crossband communications with American Army, Navy and Air Force Stations
Remembrance Day Contest	2nd weekend in August	Making contacts all over Australia and New Zealand
Australia/New Zealand Oceania DX Contest	October — 1st weekend October — 2nd weekend	Voice operating Morse operating
CQ Worldwide DX Contest	October — last weekend November — 4th weekend	Voice operating Morse operating
Jamboree On the Air	3rd weekend in October	Scouting groups throughout the world make radio contact

MESSAGES

The messages which you exchange during contests vary — often they are in numbers. For example, you might hear someone say, "Your number is 58002 QSL."

You would reply, "QSL 58002 my number to you is 57131."

"Roger, 57131 good luck in the contest."

"QRZ? W6AA CALIFORNIA."

In this example of the use of numbers in contests the first two figures represent the RS (readability and strength) signal report, or, in morse code, it would be the first three figures for the RST report. The last three figures are the number of stations to whom you have spoken in the contest, e.g. 58002 means you have spoken to 2 stations in the contest, and 57131 means you have spoken to 131 stations.

EMERGENCY PRACTICE CONTESTS

On a more serious level, the Wireless Institute Civil Emergency Network (WICEN) (see page 158) organises contests in which amateurs have to deal with a variety of simulated emergencies in preparation for the real thing.

Full details (dates, rules, conditions of entry etc.) of all contests in which Australians can participate are published in the WIA's monthly magazine *Amateur Radio*.

(I reckon this magazine is real value – all for the price of WIA membership).

ON AIR RADIO NETWORKS (OR NETS)

Networks consist of groups of amateurs who join together in order to handle their on-air activites in an organised way.

The Nets are really on air 'clubs' organised by amateurs who share a common interest in a special subject — there's even a UFO Net conducted by unidentified flying object enthusiasts!

Some other Nets that may interest you are:

The Mickey Mouse Net

Near the top end of 20 metres, a worldwide network of amateurs enjoy listening daily for position reports from yachts, ships and pleasure craft.

By keeping in contact as vessels cruise around the ocean, the Mickey Mouse or Maritime Mobile Net is able to provide weather details and assistance in times of trouble.

Mobile Convoy Nets

If you are travelling with a number of vehicles, then road and safety information can be passed on by developing a mobile net using three simple rules.

1. The Net control station must lead the convoy of vehicles.

2. Anyone wishing to change frequency to chat with another station must request the permission of the control station so that control knows where to locate all stations in the mobile Net.
3. Leave a pause of at least three seconds between transmissions to allow people within and out of the Net to break-in.

You will find that a well organised mobile Net will get you to your destination faster, safer and more enjoyably than a lone car trip.

Morse Code Net Operating

Morse code Nets use "QN" codes which make it easy to have a large number of people checking in and out of a Net. People normally change to another frequency to conduct a contact and return to the Net listening frequency at the end of the contact.

As in voice, the Net control station operator's instructions must be followed by each person if the Net is to run smoothly and efficiently.

QN SIGNALS

*QNA	Answer in pre-arranged order
*QNB	Act as relay between . . . and . . .
QNC	All net stations copy. I have a message for all net stations.
*QND	Net is directed (controlled by a net control station)
*QNE	Entire net please standby
QNF	Net is FREE (not controlled by a net control station)
QNG	Take over as net control station
QNH	Your net frequency is high
QNI	All net stations report in. I am reporting into the net
QNJ	Can you copy me? Can you copy. . . ?
*QNK	Transmit messages for . . . to . . .
QNL	Your net frequency is low
*QNM	You are interfering with the net. Please stand by.
QNN	Net control station is . . . Which station is the net control?
QNO	I am leaving the net
QNP	Unable to copy you (or . . .)
QNR	Can I use this frequency for a short message to . . .
QNS	Following stations are in the net (followed with a list)
QNS	Request list of stations in the net
QNT	Leaving net temporarily (or for . . . minutes)
QNU	The net has traffic for you. Standby
QNX	Request to be excused from the net. You are excused from the net.
QNZ	Zero beat your signal with mine

*For Use By Net Control Stations Only

Emergency Traffic Nets

The Boy Scout "Be Prepared" motto is good advice for the amateur willing to help out in emergencies.

- Make sure your stations contains emergency power which will keep you on the air during a failure in the main 240 volts power supply source.
- Participate in simulated emergency nets to test your equipment and operating skills.
- Register your availability for emergency service with the Wireless Institute Civil Emergency Network (WICEN) Co-ordinator in your State.

During the emergency:

- Listen before you transmit.
- If no net exists take the initiative and form one.
- Strict discipline must be observed on an emergency net. Follow the net controller's instructions. Do not make unnecessary transmissions.
- Be ready to assist but stay off the air unless you can handle a specific job more efficiently than any other station.

After the emergency:

Report the results promptly and fully to WICEN so that full details can be supplied to public relations personnel.

Radio Club Nets

If you belong to a local amateur radio club, you will probably get involved in regular nets passing on local news and information.

AMATEUR RADIO LOGBOOKS

When you make contact with another station, you must fill out the details of your contact in a logbook.

Not only does your logbook provide a helpful record of the names, locations etc. of all your contacts, but a radio branch inspector can legally request to see it.

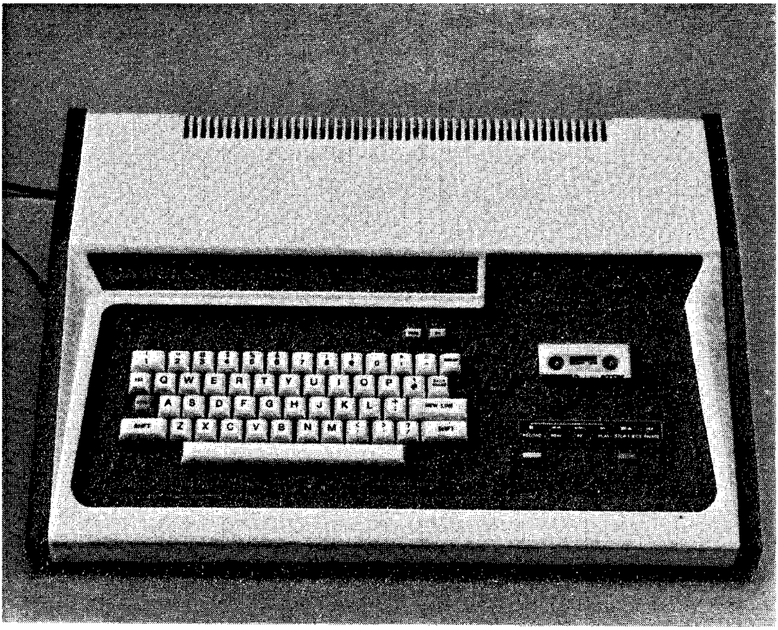
The logbook must contain the following information:

DATE
TIME
FREQUENCY
TYPE OF TRANSMISSION, e.g. AM or SSB
SIGNAL REPORTS EXCHANGED

Often logbooks also contain additional space so that you can note down whether you have sent or received a QSL card.

QSL CARDS

When you make a contact on air, it's fun to swap QSL cards which confirm the contact in writing. QSL cards are of postcard size and are to the radio amateur what stamps are to the stamp collector.



The ultimate in log books! Some amateurs now use a mini computer for log keeping functions especially during contests.

A typical QSL might look like this:-

TO RADIO ....CONFIRMING OUR QSO	QSO is 'contact
ON ....MHz 2 WAY FM/AM/SSB/CW	
AT EST/GMT ON.....................1978	EST is 'Eastern Standard Time'
Ur Sigs RST................................RS.................	UR Sigs — is 'your signals were'
TX...........................INPUT/OUTPUT.................	TX is 'my transmitter is'
RX ....ANT.....................	RX is 'my receiver is' ANT is 'my antenna is'
Rmks	Rmks is 'remarks'
....	
TNX FB QSO PSE QSL TNX	TNX is 'thank you' FB is 'for the fine'
Followed by your name and address	QSO is 'contact'

On this QSL you just circle the parts which apply. For example, if you want to say "Please QSL" ("Please send me your card".) You would indicate this by circling PSE QSL TNX.

Some amateurs use the cards to decorate the walls of their radio shack. Others make a project out of collecting them in photo albums.

Amateurs sometimes specialise in collecting QSL cards from stations using unusual prefixes. For example, in Australia, on special occasions such as the Captain Cook Bicentenary and the Queen's Jubilee visit, amateurs have used the prefix 'AX' instead of 'VK' — the world, of course, tries to collect these special QSL cards with the unusual AX prefix.

(You might be interested to know I received a QSL card from Russian Antarctica the other day. No one down there has heard of Boris. I suppose the CIA made him change his name.)

QSL BUREAUS

To save money in posting QSL cards, special bureaus have been set up all over the world.

All you do is mail all your QSL cards to the QSL bureau in your state and for a fee of one cent per card if you are a WIA member and slightly more if you are not, the bureau will send your cards to any part of Australia or the world.

The Inward section of the bureau receives your QSL card and sends it overseas or wherever. The Outward section receives cards addressed to you and forwards them on to you. Normally, you provide stamped self addressed envelopes to assist.

QSL bureaus are operated voluntarily by WIA members.

AUSTRALIAN QSL BUREAUS

VK1	QSL Officer, P.O. Box 46, CANBERRA 2600
VK2	QSL Bureau, C/- Hunter Branch, P.O. TERALBA NSW 2284
VK3	QSL Bureau (inwards), Mrs B. Gray, VK3BYK, 1 Amery St, ASHBURTON VIC 3147
VK3	QSL Bureau (outwards), Mr R.R. Prowse, VK3XY, 83 Brewer Rd, BENTLEIGH VIC 3204
VK4	QSL Officer, G.P.O. Box 638, BRISBANE QLD 4001
VK5	QSL Bureau, Mr R. Dobson, VK5DI, 16 Howden Rd, FULHAM S.A. 5024
VK6	QSL Bureau, Mr J. Rumble, VK6RU, G.P.O. Box F319, PERTH WA 6001
VK7	QSL Bureau, G.P.O. Box 371D, HOBART TAS 7001
VK8	QSL Bureau, C/- VK8HA, P.O. Box 1418, DARWIN NT 5794
VK9, VK0	Federal QSL Bureau, Mr N. Penfold, VK6NE, 388 Huntriss Rd, WOODLANDS W.A. 6018

AWARDS

Each year the WIA issues hundreds of awards for special achievements in amateur radio. These awards are in the form of attractive certificates which can be proudly hung up on the shack wall.

The awards are given for many different reasons ranging from services rendered to amateur radio to achieving the required number of contacts on a particular band in particular circumstances. QSL cards are the proof used for most awards.

Full details of awards can be obtained from Bill Verrall (VK5WV), 7 Lilac Avenue, Flinders Park, SA 5025.

OTHER AMATEUR ACTIVITIES

The range of these is too great and varied to list in detail here, but they include:

- Field Days (outdoor displays of the latest in amateur gear and information.)
- Weekend Radio Camping Trips (usually in the mountains on a good DX site.)
- Fox Hunts (searching for the location of a hidden transmitter.)
- Conventions.

And that's just the tip of the activity iceberg. Full details of these and other activities are always listed in *Amateur Radio*.

Chapter

14

Amateur Radio Clubs

Amateur Radio Clubs

The Wireless Institute of Australia, affectionately known as the WIA to amateurs all over Australia, is the national organisation dedicated to promoting the use and enjoyment of amateur radio.

JOINING THE WIA

Anyone, with or without an amateur licence, can join the WIA.

The benefits of membership are quite considerable.

If you're interested in DXing, satellites, Amateur TV, helping others get into amateur radio, novice radio, buying amateur gear, building your own gear, QSL cards, chatting to people around the world or any other aspect of amateur radio, then you will find a group within the WIA happy to help you.

(I'd like to stress that the WIA is just as interested in helping newcomers get into the game as it is in advising the experienced hobbyist on some far out technical point.)

WIA members receive the very informative magazine *Amateur Radio* free through the post each month.

If you hold any level of amateur licence, you can join the WIA as a full member — if you do not have an Amateur Licence you can join the WIA as an associate member.

To join the WIA fill in an application form obtainable from the WIA in your state. (See page 160 for list of addresses.) If you don't know anyone who can propose and second your application, just leave that section blank and a proposer and seconder will be found for you.

Annual membership fees vary from State to State but are generally around $20 with some concessions for students and pensioners.

THE WIA IN YOUR STATE

Each state has a division of the WIA which organises and supports amateur activities within that state. *(The WIA is like any organisation – it is made up of people like you and me. If there is something you think ought to be done – don't just sit back and criticise, volunteer to help.)*

The WIA holds monthly meetings — attend them if you can. This is the forum where you can express your thoughts to other members and the annually elected WIA divisional officers.

Do you think the meetings are too boring? Do you think the novices are getting a fair deal? Do you agree with all the amateur regulations? Would you like to volunteer yourself as Publicity Officer for the State? Would you like to form a newcomer's group in your division? . . . Is the cost of fish and chips too high? . . .

WEEKLY AMATEUR RADIO NEWS BROADCASTS

The WIA conducts weekly Sunday morning broadcasts of the latest amateur radio news in each state.

News of the latest national and international radio developments, changes in the Amateur Regulations, the ionospheric predictions for the coming week, the latest DX flashes, the times you can expect to pick up the orbiting Amateur Satellites and the latest club news from around your State . . . these are just some of the gems of information you can pick up regularly each Sunday. (See Chapter 7 for details of times and frequencies.)

If you have any news for these broadcasts, all you do is send it in by letter to your State WIA and it will be transmitted on the Sunday.

At the end of the broadcast, "call backs" are conducted where you can report how well you picked up the broadcast and ask any questions you may have.

You might decide to volunteer yourself as a news reader and have a go at being at the controls of the WIA broadcast station. You can even volunteer to relay the WIA from one band onto another to provide additional coverage of the broadcast.

SPECIAL INTEREST GROUPS

The following special interest groups which hold meetings each month are typical. (For details of groups near you write to the WIA in your State. Addresses are listed on page 160.)

Youth Radio Service (YRS)

This group of amateurs, forming part of the WIA educational service, enjoys helping newcomers to amateur radio. They provide novice licence study material for individuals and radio clubs, and advise on how to start up and run your own local radio club.

Information and assistance can be obtained from:

NSW
Ken Hargraves,
52 Marling Ave, FLORAVILLE 2280

VICTORIA
Rev. Bro. Frank Whittom,
St. Johns College, 204 Churchill Ave,
BRAYBROOK 3019
OR
YRCS Exams, c/- J. Kolm,
11 Vista Ave, KEW 3101

QUEENSLAND	WIA, GPO Box 638, BRISBANE 4001
SOUTH AUSTRALIA	G. Preston, 13 McGowan Rd, PARA HILLS 5096
WESTERN AUSTRALIA	WIA, GPO Box N1002, PERTH 6001
TASMANIA	Reg Emmett, 111 New World Ave, TREVALLYN 7350

The Wireless Institute Civil Emergency Network (WICEN)

This group of amateurs is interested in the ways that amateurs can assist in times of emergency. WICEN co-operates with the National Disasters Organisation, State Emergency Services and Police.

WICEN organises emergency training sessions and community communicatons exercises for interested amateurs.

Intruder Watch

The Intruder Watch group co-ordinates the reporting of unauthorised transmissions within the amateur bands.

Many Government, commercial and other transmissions can be found within the exclusive worldwide amateur allocations.

Intruder Watch correlates and investigates all such reports and forwards these to Government representatives for action in an effort to keep amateur allocations free of unauthorised use.

Short wave listeners and amateurs around the country are invited to send reports on 'intruders' to the Intruder Watch Co-ordinator c/o the WIA in their State.

The VHF and TV Group

VHF, UHF and SHF enthusiasts meet together to discuss the latest developments or interesting occurrences in this fascinating area of radio. All sorts of outings, fox hunts and contests are organised.

The Novice Amateur Group

The main interest of this group is to help people obtain their novice licence. The group organises classes for morse code, theory and regulations.

Field trips and general novice discussion meetings are other aspects of the group's activities.

The Short Wave Listeners Group

This group combines shortwave listening and amateur radio. They produce a monthly magazine and organise weekend field DX camping trips into the mountains. Newcomers are made particularly welcome at meetings.

The Radio Teletype (or the RTTY) Group

If you want to learn more about RTTY, this group will help you. Kits and equipment to get you started can be obtained from the group. Monthly meetings provide both the newcomer and experienced RTTY operator with a great deal of assistance and information.

LOCAL RADIO CLUBS

Joining your local radio club is a great way to learn more about radio and make new friends within a common interest group. You'll find most clubs really welcome new members and go out of their way to help them.

See page 181 for an extensive list of Australian amateur radio clubs. Is there one near you?

Club activities obviously vary a good deal but they usually include conducting licence study courses, construction projects, field trips, contests — and generally talking about amateur radio.

What if there isn't a club near you? Why not start one yourself? All it needs is one keen person to get a club off the ground. Age shouldn't be a barrier either — there are lots of good school clubs around.

The best way to go about forming your own club is to enlist the aid of the Youth Radio Service (see page 157) — they're ready, willing and able to help.

And who knows where it could all lead to . . . a seat on the Federal WIA?

THE FEDERAL WIA

The Federal WIA is the national group co-ordinating amateur radio in Australia.

The Federal WIA is in contact with the Department of Post and Telecommunications regarding all matters affecting amateur radio licencing, examinations and regulations.

Your views on all these issues go straight to the Federal Executive through your State Divisional WIA Council.

Each year, a WIA Federal Conference is held to express the views of the members in each State towards national and international issues.

WORLD ADMINISTRATIVE RADIO CONFERENCE

All frequencies used by amateurs and all other radio users are determined at the World Administrative Radio Conference (WARC) organised by the International Telecommunications Union (ITU).

Each country around the world has one vote when it comes to deciding frequency allocation for each of the radio users.

The WIA is responsible for preparing a case for retaining present or even expanding future amateur allocations. This information is presented to the Australian Government for international debate and consideration at the WARC.

INTERNATIONAL AMATEUR RADIO UNION

The International Amateur Radio Union (IARU) is the affiliation of all the National Amateur Radio Societies around the world. At meetings organised by the United Nations, International Telecommunications Union (ITU), the IARU examines all proposals which affect amateur radio.

ADDRESS LIST FOR THE WIRELESS INSTITUTE OF AUSTRALIA

WIA Division	**Address & Phone Number**
ACT	P.O. Box 46, CANBERRA 2600
NSW	14 Atchison St., CROWS NEST 2065 PH: (02) 43-5795 Tues/Thurs 10am-2pm
VICTORIA	412 Brunswick St., FITZROY 3065 PH: (03) 41-3535 Sat. 10am-12 noon
QUEENSLAND	G.P.O. Box 638, BRISBANE 4001
SOUTH AUSTRALIA	G.P.O. Box 1234, ADELAIDE 5001 Located at West Thebarton Rd, Thebarton PH: (08) 254-7442
WESTERN AUSTRALIA	G.P.O. Box N1002, PERTH W.A. 6001
TASMANIA	P.O. Box 1010, LAUNCESTON 7250
NORTHERN TERRITORY	(part of the South Aust. division) Darwin Amateur Radio Club, P.O. Box 37317, WINNELLIE NT 5789

FEDERAL EXECUTIVE OF THE WIA

P.O. Box 150, TOORAK, MELBOURNE,. VICTORIA 3142

(It just had to happen. The final report on Boris. He's defected to Canberra. Now he doesn't hassle with satellites – he just phones me collect. Nyet, nyet, nyet! Do me a favour, Boris – get your Australian licence. Maybe someone in Moscow wants to talk to you? And there's that blonde in Hoboken . . .)

Chapter

15

Short Wave Listening

Short Wave Listening

Better known as "SWL'ing", short wave listening is not only a fun hobby but it's an excellent way to become involved in amateur radio. *(That's where it all began for me.)*

Carefully twisting the knob on your receiver you can listen in to an incredibly variety of radio activities — amateurs, CB'ers, ships, planes, international short wave broadcasting stations, police, spy stations, satellites, military stations . . . *(I'd run out of space if I listed them all!)*

SHORT WAVE RECEIVERS

General coverage short wave receivers usually tune from 550 KHz in the broadcast band up to 30 MHz in the short wave band.

The cheapest and most common way to start is to buy a small short wave portable radio. These normally cover from 550 to 1600 KHz on medium wave and 6 to 12 MHz on short wave. These are quite common and you may even have one in your home or perhaps a relative has one which is not being used.

After you have gained some experience from a simple set and collected a bit more money, you will probably start looking for a better short wave receiver.

If you're mainly interested in listening in to amateurs, make sure that your receiver covers the bands 160 through to 10 metres and has some

SSB receiving facility. The Yaesu FRG-7 is ideal for general purpose and amateur reception.

To listen into amateurs on the VHF, UHF and SHF bands you could connect receiving converters onto your short wave receiver.

LOGBOOKS AND QSL CARDS

Serious short wave listeners often keep a logbook recording the date, time, frequency and reception quality. If you want to confirm that you actually did hear a particular station, the best way is to send away for a QSL card. You can send all the details in your logbook in the form of a letter. It might be something like this:

Dear Sir,

I would like to report hearing your station. Please send me your QSL card or QSL verification letter if this information is correct.

Date .... 21-1-82 ....

Time (GMT) .... 1200 ....

Frequency .... 121 KHz ....

Reception .... V. GOOD 5/9 ....

Here are 15 minutes of programme details or (if you are writing to an amateur) I heard you in contact with............

Mr receiver is .... NATIONAL 6 TRANSISTOR ....

My antenna is .... LONG WIRE ....

My hobbies are .... SWL & GIRLS ....

Any other personal remarks .... I'LL TRY TO DROP BY ON MY NEXT ROUND THE WORLD HELICOPTER EXPEDITION ....

I am looking forward to hearing from you.

73s

Dick Smith
VK2ZIP

ADDRESSES

Addresses of radio amateurs are listed in the *Australian Amateur Radio Call Book* available from the WIA in your state.

Exact addresses and information on times and frequencies for the overseas broadcast stations are given in a book called *The World Radio TV Handbook* — it's the SWL'ers bible.

SWL CLUBS

If you join the WIA you are issued with your own short wave listener's call sign (e.g. WIA L2000).

As well as the SWL groups within each WIA division, two other national groups provide useful information for the keen SWL'er. They are the Southern Cross DX Listener's Club, G.P.O. Box 336 Adelaide SA 5001 and the Australian Radio DX Listeners Club, P.O. Box 67, Highett, VIC. 3190.

For more information on SWL'ing *Australian Short Wave Listening* by Art Cushen is an excellent reference book.

THE INTERNATIONAL MORSE CODE

A	. _	"didah"	T	_	"dah"
B	_ . . .	"dahditditdit"	U	. . _	"dididah"
C	_ . _ .	"dahdidahdit"	V	. . . _	"didididah"
D	_ . .	"dahdidit"	W	. _ _	"didahdah"
E	.	"dit"	X	_ . . _	"dahdididah"
F	. . _ _	"dididahdit"	Y	_ . _ _	"dahdidahdah"
G	_ _ .	"dahdahdit"	Z	_ _ . .	"dahdahdidit"
H	. . . .	"dididit"	1	. _ _ _ _ _	di dah dah dah dah
I	. .	'didit"	2	. . _ _ _ .	di di dah dah dah
J	. _ - -	"didahdahdah"	3	. . . _ _	di di di dah dah
K	_ . _	"dahdidah"	4	. . . . _	di di di di dah
L	. _ . .	"didahdidit"	5	. . . . .	di di di di dit
M	_ _	"dahdah"	6	_	dah di di di dit
N	_ .	"dahdit"	7	_ _ . . .	dah dah di di dit
O	_ _ _	"dahdahdah"	8	_ _ _ . .	dah dah dah di dit
P	. _ _ .	"didahdahdit"	9	_ _ _ _ .	dah dah dah dah dit
Q	_ _ . _	"dahdahdidah"	0 or		
R	. _ .	"didahdit"	zero	_ _ _ _ _ _	dah dah dah dah dah
S	. . .	"dididit"			

The length of transmission time for one dah = three dits.
The time space between two letters = three dits.
The time space between two words = seven dits.

LOCAL/UNIVERSAL TIME CHART

UTC GMT or ZULU-TIME	New Guinea-(Papua) NSW Queensland Victoria LOCAL TIME	Northern Territory South Australia LOCAL TIME	Western Aust. LOCAL TIME	N.Z. LOCAL TIME
2400 or 0000	10 am	9.30 am	8 am	midday
0100	11 am	10.30 am	9 am	1 pm
0200	midday	11.30 am	10 am	2
0300	1 pm	12.30 pm	11	3
0400	2	1.30	12	4
0500	3	2.30	1 pm	5
0600	4	3.30	2	6
0700	5	4.30	3	7
0800	6	5.30	4	8
0900	7	6.30	5	9
1000	8	7.30	6	10
1100	9	8.30	7	11
1200	10	9.30	8	12
1300	11	10.30	9	1 am
1400	midnight	11.30	10	2
1500	1 am	12.30	11	3
1600	2	1.30	12	4
1700	3	2.30	1 am	5
1800	4	3.30	2	6
1900	5	4.30	3	7
2000	6	5.30	4	8
2100	7	6.30	5	9
2200	8	7.30	6	10
2300	9	8.30	7	11

AUSTRALIAN DXCC COUNTRIES LIST

A2	Botswana (AF, 38)
A3	Tonga (O, 32)
A4	Oman (A, 21)
A5	Bhutan (A, 22)
A6	United Arab Emirates (A, 21)
A7	Qatar (A, 21)
A9	Bahrein (A, 21)
AP	Pakistan (A, 21)
BV	Taiwan (A, 42)
BY	China (A, 23)
C2	Nauru (O, 31)
C3	Andorra (E, 14)
C5	The Gambia (AF, 35)
C6	Bahama Is. (NA, 8)
C9	Mozambique (AF, 37)
CE	Chile (SA, 12)
CE9AA-AM, FB8Y, KC4, LA, LU-Z, OR4, UA1, UK1, VP0, VP8, ZL5, ZS1, 3Y, 4K, 8J	Antartica
CE0A	Easter Is. (SA, 12)
	(SA, 12, 13; O, 29, 30; AF, 38, 39)
CE0X	San Felix (SA, 12)
CE0Z	Juan Fernandez (SA, 12)
CM, CO	Cuba (NA, 8)
CN	Morocco (AF, 33)
CP	Bolivia (SA, 10)
CR9	Macao (A, 24)
CT	Portugal (E, 14)
CT2	Azores (E, 14)
CT3	Madeira (AF, 33)
CX	Uruguay (SA, 13)
D2, 3	Angola (AF, 36)
D4	Cape Verde Is. (AF, 35)
D6, 7, 8	Comoros (AF, 39)
DA, DF, DJ, DK, DL	Federal Republic of Germany (West) (E, 14)
DM, DT	German Democratic Republic (East) (E, 14)
DU	Philippine Is. (O, 27)
EA	Spain (E, 14)
EA6	Balearic Is. (E, 14)
EA8	Canary Is. (AF, 33)
EA9	Ceuta and Melilla (AF, 33)
E1	Republic of Ireland (E, 14)
EL	Liberia (AF, 36)
EP	Iran (A, 21)
ET	Ethiopia (AF, 37)
F	France (E, 14)
FB8W	Crozet (AF, 39)
FB8X	Kerguelen Is. (AF, 39)
FB8Z	Amsterdam & St. Paul Is. (AF, 39)
FC	Corsica (E, 15)
FG	Guadeloupe (NA, 8)
FG, FS	Saint Martin (NA, 8)
FH	Mayotte (AF, 39)
FK	New Caledonia (O, 32)
FM	Martinique (NA, 8)
FO	Clipperton Is. (NA, 7)
FO	French Oceania (O, 32)
FP	St. Pierre & Miquelon (NA, 5)
FR	Glorioso Is. (AF, 39)
FR	Juan de Nova Europa (AF, 39)
FR	Reunion (AF, 39)
FR	Tromelin (AF, 39)
FW	Wallis & Futuna Is. (O, 32)
FY	French Guyana (SA, 9)
G	England (E, 14)
GD	Isle of Man (E, 14)
G1	Northern Ireland (E, 14)
GJ, GC	Jersey (E, 14)
GM	Scotland (E, 14)
GU, GC	Guernsey & Dependencies (E, 14)
GW	Wales (E, 14)
H4	Solomon Is. (O, 28)
HA	Hungary (E, 4)
HB	Switzerland (E, 14)
HB0	Leichtenstein (E, 14)
HC	Ecuador (SA, 10)
HC8	Calapago Is. (SA, 10)
HH	Haiti (NA, 8)
HI	Dominican Republic (NA, 8)
HK	Columbia (SA, 9)
HK0	Bajo Neuvo (NA, 7)
HK0	Malpelo (SA, 9)
HK0	San Andrea, Providencia (NA, 7)
HL, HM	Korea (A, 25)
HP	Panama (NA, 7)
HR	Honduras (NA, 7)
HS	Thailand (A, 26)
HV	Vatican City (E, 15)
HZ, 7Z	Saudi Arabia (A, 21)
I, IT	Italy (E, 15)
IS	Sardinia (E, 15)
J2, FL8	Djibouti (AF, 37)
J3, VG2G	Grenada & Dependencies (NA, 8)
J5, CR3	Guinea Bissau (AF, 35)
J6, VP2I	St. Lucia (NA, 8)
J7, VP2D	Dominica (NA, 8)
JA, JE, JF, JG, JH, JI, JJ, JL, JK, JR, KA	Japan (A, 25)
JD, KA1	Minami Tobishima (A, 27)
JD, KA1	Ogasawara (A, 27)
JT	Mongolia (A, 23)

JW .... Svalbard (E, 40)
JX .... Jan Mayen (E, 40)
JY .... Jordan (A, 20)
AA-AJ, K, KA, KB, KC, N, WA, WB, WC, WD, WR ... USA (NA, 3, 4, 5)

KC6 ..... Eastern Caroline Is. (O, 27)
KC6 .... Western Caroline Is (O, 27)
KG4 .... Guantanamo Bay (NA, 8)
KG6A, J, R, S, KH0 Manana Is. (O, 27)
KH1, KB6 .... Baker, Howland & American Phoenix Is. (O, 31)
KH2, KG6, AH2, WH2 . Guam (O, 31)
KH3, KJ6, WH3 Johnston Is. (O, 31)
KH4, KM6, WH4 Midway Is. (O, 31)
KH5, KP6 ..... Kingman Reef (O, 31)
KH5, KP6 Palmyra, Jarvis Is. (O, 31)
KH6, AH6, WH6 Hawaiian Is. (O, 31)
KH6, KH7 .... Kure Is. (O, 31)
KS6, KH6, WH8, AH8 ...... American Samoa (O, 31)
KH9, KW6 .... Wake Is. (O, 31)
KL7, AL7, WL7 .... Alaska (NA, 1)
KP1, KC4 .... Navassa Is. (NA, 8)
KP2, KV4, NP2, WP2 .. American Is. (NA, 8)
KP3, KS4, HK0 ...... Serrana Bank & Roncador Cay (NA, 7)
KP4, NP4, WP4 Puerto Rico (NA, 8)
KP4 .... Pesecheo Is. (NA, 8)
KX6 .... Marshall Is. (O, 31)
KZ ...... Panama Canal Zone (NA, 7)

LA .... Norway (E, 14)
LU .... Argentina (SA, 13)
LX .... Luxembourg (E, 14)
LZ .... Bulgaria (E, 20)

OA .... Peru (SA, 10)
OD .... Lebanon (A, 20)
OE .... Austria (E, 15)
OH .... Finland (E, 15)
OH0 .... Aland Is. (E, 15)
OJ0 .... Market Reef (E, 15)
OK .... Czechoslovakia (E, 15)
ON .... Belgium (E, 14)
OX .... Greenland (NA, 40)
OY .... Faroe Is. (E, 14)
OZ .... Denmark (E, 14)

P2 .... Papua New Guinea (O, 28)
PA, PD, PE, PT . Netherlands (E, 14)
PJ ..... Netherlands Antilles (SA, 9)
PJ .... St. Maarten (NA, 8)
PP-PY .... Brazil (SA, 11)
PY0 Fernando de Noronha (SA, 11)
PY0 .... St. Peter & St. Paul's Rocks (SA, 11)
PY0 .... Trinidade, Martim Vaz Is. (SA, 11)
PZ .... Surinam (SA, 9)

S2 .... Bangladesh (A, 22)
S79 .... Seychelles (AF, 39)
S9 ... Principe, Sao Thome (AF, 36)
SK, SL, SM .... Sweden (E, 14)
SP .... Poland (E, 15)

ST .... Sudan (AF, 34)
ST0 .... Southern Sudan (AF, 34)
SU .... Egypt (AF, 34)
SV1, 2, 3, 4, 5, 6, 7, 8, 0 Greece (E, 20)
SV5 .... Popecanese (E, 20)
SV9 .... Crete (E, 20)
SV .... Mt Athos (E, 20)

T2 .... Tuvalu (O, 31)
TA, YM .... Turkey (A, 20)
TF .... Iceland (E, 40)
TG .... Guatemala (NA, 7)
TI .... Costa Rica (NA, 7)
TI9 .... Cocos Is. (NA, 7)
TJ .... Cameroun (AF, 36)
TL Central African Empire (AF, 36)
TN .... Congo Republic (AF, 36)
TR .... Gabon (AF, 36)
TT .... Chad (AF, 36)
TU .... Ivory Coast (AF, 35)
TY .... Benin (AF, 35)
TZ .... Mali (AF, 35)

UA1-6; UK1, 3, 4, 5, 6A, E, H, I, J, L, U, W, X, Y; UN1; UV; UW1-6 .... European Russia (E, 6)
UA9, 0; UK; UV; UW9, 0 ..... Asiatic Russia (A, 18; A, 19)
UA1, UK1 Franz Josef Land (E, 40)
UA2, UK2F .... Kaliningradsk (E, 15)
UB, UK, UT, UYS ... Ukraine (E, 16)
UC2, UK2A, C, I, L, O, S, W .. White Russia (E, 16)
UD6, UK6C, D, K Azerbaijan (A, 21)
UF6, UK6F, O, Q, V Georgia (A, 21)
UG6, UK6G .... Armenia (A, 21)
UH8, UK8H .... Turkoman (A, 17)
UI8, UK8A, C, D, F, G, I, L, O, T, U, Z .... Uzbeck (A, 17)
UJ8, UK8J, R .... Tadzhik (A, 17)
UL7, UK7 .... Kazakh (A, 17)
UM8, UK8M, N .... Kirghiz (A, 17)
UO5, UK5O .... Moldavia (E, 16)
UP2, UK2B, P .... Lithuania (E, 15)
UQ2, UK2G, Q .... Latvia (E, 15)
UR2, UK2R, T .... Estonia (E, 15)

VE, VO, VY, CG ...... Canada (NA, 1, 2, 3, 4, 5)
VE1, VY9 .... Sable Is. (NA, 5)
VE1, VY0 .... St. Paul Is. (NA, 5)
VK, AX .... Australia (O, 29, 30)
VK2 .... Lord Howe Is (O, 30)
VK9 .... Christmas Is. (O, 29)
VK9 .... Cocos Is (O, 29)
VK9 .... Mellish Reef (O, 30)
VK9 .... Norfolk Is. (O, 32)
VK9 .... Willis Is. (O, 30)
VK0 .... Heard Is. (O, 39)
VK0 .... Macquarie Is. (O, 30)
VP1 .... Belize (NA, 7)
VP2A ...... Antigua, Barbuda (NA, 8)
VP2E .... Anguilla (NA, 8)
VP2K .... St. Kitts Nevis (NA, 8)
VP2M .... Montserrat (NA, 8)
VP2S .... St. Vincent (NA, 8)
VP2V .... British Virgin Is. (NA, 8)

VP5	Turks and Caicos Is. (NA, 8)
VP8	Falkland Is. (SA, 13)
VP8, LU-Z	South Georgia (SA, 13)
VP8, LU-Z	South Orkney (SA, 13)
VP8, LU-Z	South Sandwich (SA, 13)
VP8, LU-Z, CE9AN-AZ	South Shetland (SA, 13)
VP9	Bermuda (NA, 5)
VQ9	Chagos (AF, 39)
VR1	British Phoenix Is. (O, 31)
VR1	Gilbert Is. (O, 31)
VR3, 7	Line Is. (O, 31)
VR6	Pitcairn Is. (O, 32)
VS5	Brunei (O, 28)
VS6	Hong Kong (A, 24)
VS9K	Kamaran Is. (A, 21)
VU	India (A, 22)
VU7	Andaman and Nicobar Is (A, 26)
VU7	Laccadive Is. (A, 22)
XE, XF	Mexico (NA, 8)
XF4	Reville Gigedo (NA, 6)
XT	Voltalo Republic (AF, 35)
XU	Khmer Republic (A, 26)
XV, ZW	Vietnam (A, 26)
XW	Laos (A, 26)
XZ	Burma (A, 26)
YA	Afghanistan (A, 21)
YB, YO	Indonesia (O, 28)
YI	Iraq (A, 21)
YJ	New Hebrides (O, 32)
YK	Syria (A, 20)
YN	Nicaragua (NA, 7)
YO	Rumania (E, 20)
YS	El Salvador (NA, 7)
YU	Yugoslavia (E, 15)
YV	Venezuela (SA, 9)
YV0	Aves Is. (SA, 9)
ZA	Albania (E, 15)
ZB2	Gibraltar (E, 14)
ZD7	St. Helena (AF, 36)
ZD8	Ascension Is. (AF, 36)
ZD9	Tristan de Cunha, Gough Is. (AF, 38)
ZE	Rhodesia (AF, 38)
ZF	Cayman Is. (NA, 8)
ZK1	Cook Is. (O, 32)
ZK1	Manahiki Is. (O, 32)
ZK2	Niue (O, 32)
ZL	New Zealand (O, 32)
ZL	Auckland, Campbell Is. (O, 32)
ZL	Chatham Is. (O, 31)
ZL	Kermadee Is. (O, 32)
ZM7	Tokelaus (O, 31)
ZP	Paraguay (SA, 11)
ZS	South Africa (AF, 38)
ZS8	Prince Edward, Marion Is. (AF, 38)
ZS3	Nambia (AF, 38)
1S	Spratly Is. (A, 26)
3A	Monaco (E, 14)
3B6, 7	Agalega, St. Brandon (AF, 39)
3B8	Mauritius (AF, 39)
3B9	Rodriguez (AF, 39)
3C	Equatorial Guinea (AF, 36)
3C0	Annobon (AF, 36)
3D2	Fiji Is. (O, 32)
3D6	Swaziland (AF, 38)
3V	Tunisia (AF, 33)
3X	Republic of Guinea (AF, 35)
3Y	Bouvet Is. (AF, 38)
4S	Sri Lanka (A, 22)
4U1	ITU Headquarters Geneva (E, 14)
4U1UN	United Nations Headquarters New York (NA, 5)
4W	Yemen (A, 21)
4X, 4Z	Israel (A, 20)
5A	Libya (AF, 34)
5B, ZC	Cyprus (A, 20)
5H	Tanzania (AF, 37)
5N	Nigeria (AF, 35)
5R	Malagasy (AF, 39)
5T	Mauritania (AF, 35)
5U	Niger Republic (AF, 35)
5V	Togo (AF, 35)
5W	Western Samoa (O, 32)
5X	Uganda (AF, 37)
5Z	Kenya (AF, 37)
6O	Somali (AF, 37)
6W	Senegal (AF, 35)
6Y	Jamaica (NA, 8)
7O	South Yemen (A, 21)
7P	Lesotho (AF, 38)
7Q	Malawi (AF, 37)
7X	Algeria (AF, 33)
8P	Barbados (NA, 8)
8Q, VS9M	Maldive Is. (A, 22)
8R	Guyana (SA, 9)
8Z4	Saudi Arabia/Iraq Neutral Zone (A, 21)
9A, M1	San Marino (E, 15)
9G	Ghana (AF, 35)
9H	Malta (E, 15)
9J	Zambia (AF, 36)
9K	Kuwait (A, 21)
9L	Sierra Leone (AF, 35)
9M2, 4	West Malaysia (A, 28)
9M6, 8	East Malaysia (A, 28)
9N	Nepal (A, 22)
9Q	Zaire (AF, 36)
9U	Burundi (AF, 36)
9V	Singapore (A, 28)
9X	Rwanda (AF, 36)
9Y	Trinidad (SA, 9)
Abu Ali, Jabal at Tair	(AF, 37)

DELETED COUNTRIES LIST

Countries listed below in the deleted countries section only have DXCC validity for the dates indicated beside each country.

AC3 - Sikkim (prior May 1st 1975).
AC4 - Tibet (prior June 1st, 1974).
C9 - Manchuria (prior September 16th, 1963).
CN2 - Tangier (prior July 1st, 1960).
CR8 - Damao, Dlu (prior January 1st, 1962).
CR8 - Gos (prior January 1st. 1962).
CR8 - Port. Timor (prior September 15th, 1978).
DA, DJ, DK, DL, DM - Germany (prior September 17th, 1973).
EA9 - Ifni (prior May 14th, 1969).
EA9 - Rio de Oro (prior August 1st, 1978).
ET2 - Eritres (prior November 15th, 1962).
FF8 - French West Africa (prior August 7th, 1960).
GH - Comoros (prior July 6th, 1975).
F18 - French Indo-China (prior December 21st. 1950).
FN - French India (prior November 1st, 1954).
GQ8 - French Equatorial Africa (prior August 17th, 1960).
11 - Trieste (prior April 1st, 1957).
15 - Italian Somaliland (prior July 1st, 1960).
JZ - Netherlands New Guinea (prior May 1st, 1963).
KR6, 8, JR6, KA6 - Ryukyu Islands (prior May 5th, 1972).
KS4 - Swan Islands (prior September 1st, 1972).
VK9 - Papua Territory (prior September 16th, 1975).
VK9 - Territory of New Guinea (prior September 16th, 1975).
PK1, 2, 3 - Java (prior May 1st, 1963).
PK4 - Sumatra (prior May 1st, 1963).
PK5 - Netherlands Borneo (prior May 1st, 1963).
PK6 - Celebes and Molucca Is. (prior May 1st, 1963).
UN1 - Karelo-Finnish Republic (prior July 1st, 1960).
V0 - Newfoundland, Labrador (prior April 1st, 1949).
VQ1, 5H1 - Zanzibar (prior June 1st, 1974).
VQ6 - British Somaliland (prior July 1st, 1960).
VQ9 - Aldabra (prior June 29th, 1976).
VQ9 - Desroches (prior June 29th, 1976).
VQ9 - Farquhar (prior June 29th, 1976).
VS4 - Sarawak (prior September 16th, 1963).
VS9H - Kurla Muria Is. (prior November 30th, 1967).
AC5 - British North Borneo (prior September 16th, 1963).
ZC6 - Palestine (prior July 1st, 1968).
ZD4 - Gold Coast, Togoland (prior March 6th, 1957).
1M - Minerva Reefs (prior July 16th, 1972).
9K3, 8Z5 - Kuwait/Saudi Araba Neutral Zone (prior December 15th, 1969).
9M2 - Malaya (prior September 16th, 1963).
9S4 - Saar (prior April 1st, 1957).
9U5 - Ruanda-Urundi (July 1st, 1960, to July 1st, 1962, ONLY).
Blenheim Reef - (May 4th, 1967, to July 1st, 1975, ONLY).
Guyser Reef - (Only contacts after May 4th, 1967).

DEPARTMENT OF COMMUNICATIONS
SAMPLE PAPER — NOVICE AMATEUR OPERATOR'S CERTIFICATE OF PROFICIENCY

SECTION (O) THEORY

(time allowed — 1 hour) *Candidate's No.* ....
Place of Examination ....

Questions should be answered by encircling the letter associated with the correct answer.

Example: Q. The sum of 2 and 3 is:
(a) 4;
[✓ (b)] 5;
(c) 6;
(d) 9.

If a candidate accidentally encircles an incorrect letter, he should cross out the indicating letter and rewrite it and encircle the correct letter.

Example: Q. The sum of 2 and 3 is:
(a) 4;
[✓ (b)] 5;
(c) 6;
(d) ~~(d)~~ 9.

If an incorrect letter is encircled the answer will be deemed incorrect.

1. The resonant frequency of a parallel tuned circuit may be determined by using a:
   - (a) cavity resonator.
   - (b) frequency meter.
   - (c) grid dip oscillator.
   - (d) cathode-ray oscilloscope.

2. A discriminator is commonly used for the detection of:
   - (a) frequency modulated emissions.
   - (b) frequency shift keyed emissions.
   - (c) amplitude modulated double sideband emissions.
   - (d) single sideband suppressed carrier emissions.

3. An SWR meter measures the standing wave ratio on a transmission line by comparing:

(a) the voltage at the ends of the antenna to the voltage at the feed point.
(b) the ratio of the maximum voltage to the maximum current in the antenna.
(c) The power fed to an antenna to the power reflected back from the antenna.
(d) the ratio of the maximum voltage to the maximum current in the transmission line.

4. Communication between stations operating in the very high frequency (VHF) bands are usually restriced to "line of sight" operation because:

   (a) the vertically polarised signals will only travel along a horizontal path.
   (b) these frequencies are not normally refracted from the ionosphere.
   (c) the atmosphere absorbs these frequencies.
   (d) receivers are inefficient at these frequencies.

5. VHF aerials are always physically smaller than their HF counterparts because:

   (a) of the lower radiated power.
   (b) the signals do not have to cover such great distances as HF signals
   (c) radio wavelengths vary inversely with frequency.
   (d) VHF is used extensively by mobiles and small antennae must be used.

6. The function of a doubler stage in a transmitter is:

   (a) to double the frequency of the previous stage.
   (b) to double the output of the previous stage.
   (c) to enable two final stages to be fed by the one oscillator.
   (d) to act as an impedance doubling service.

7. A transmitter is likely to cause interference to broadcast or television reception when it is:

   (a) 100 per cent modulated.
   (b) 50 per cent modulated.
   (c) unmodulated.
   (d) over-modulated.

8. The final stage of a transmitter usually:

   (a) is a voltage amplifier.
   (b) is a buffer amplifier.
   (c) is a power amplifier.
   (d) does not amplify at all.

9. With reference to radio frequency propagation the "skip distance" is the:

   (a) distance from the end of the ground wave coverage to the point at which the skywave first returns to earth.
   (b) distance covered by the ground wave.
   (c) distance from the transmitter to the point at which the skywave first returns to earth.
   (d) maximum distance the signal is capable of travelling.

10. The symbols used to designate the various elements of a transistor always include an arrow-head, this element is the:

    (a) emitter.
    (b) base.
    (c) collector.
    (d) shield.

11. Relating to transistor symbols, the direction of the arrow-head indicates that is is:

    (a) a radio frequency type.
    (b) a field effect transistor (FET).
    (c) a power amplifier type.
    (d) a PNP or a NPN type.

12. Which of the following microphone types would be most suitable for use in a mobile station?:

    (a) crystal.
    (b) moving oil.
    (c) condenser.
    (d) carbon.

13. When operating a mobile station from a motor vehicle, interference to the reception of radio signals is likely to be caused by the vehicle's:

    (a) lighting equipment.
    (b) horn circuit.
    (c) ignition system.
    (d) turn indicators.

14. Parallel tuned traps are sometimes placed in the radiating section of an antenna to enable it:

    (a) to operate on more than one band of frequencies.
    (b) to prevent interference to television receivers.
    (c) to prevent interference to broadcast receivers.
    (d) to improve its directive properties.

15. What is the purpose of using electrolytic capacitors in an AC/DC power supply?:

(a) to prevent radio frequencies from entering the power mains.
(b) to improve the high frequency response of audio amplifiers.
(c) to by-pass the direct current to earth.
(d) to smooth out the ripple frequency superimposed on the direct current.

16. The type of solder used in the assembly and wiring of electronic circuits consists of:

(a) lead and zinc.
(b) lead and aluminium.
(c) lead and tin.
(d) zinc and tin.

17. A suitable flux to use when soldering small components into a radio receiver is:
(a) zinc chloride.
(b) resin.
(c) borax.
(d) spirits of salts.

18. To enable a transceiver to transmit and receive on the same antenna use is made of:

(a) a change-over relay.
(b) a dual gate F.E.T.
(c) a mixer stage.
(d) a converter.

19. Atmospheric noise is generally more pronounced when operating in the 80 metre amateur band during the:

(a) autumn.
(b) winter.
(c) spring.
(d) summer.

20. In the event of an overload occurring in an electrical circuit, which component is used to isolate the power supply?:

(a) fuse.
(b) electrolytic capacitor.
(c) transformer.
(d) panel lamps.

21. Which of the following devices depend on electro-magnetism for their operation?:
    (a) a tantalum capacitor.
    (b) a field effect transistor (FET)
    (c) a keying relay.
    (d) a light emitting diode (LED).

22. When tuning the output circuit of a radio frequency amplifier, resonance will be indicated by a meter in the anode/collector circuit when the meter reads:

    (a) the maximum current.
    (b) the minimum current.
    (c) zero current.
    (d) full scale deflection.

23. When tuning a transmitter an artificial load is often used instead of an antenna because:
    (a) signals which could cause interference to other stations are not radiated.
    (b) an antenna is not capable of loading a transmitter.
    (c) a transmitter which is artificially loaded does not waste power.
    (d) an artificial load radiates much better than an antenna.

24. It is usual to vary the frequency of a crystal oscillator by:
    (a) means of a variable capacitor in parallel with the crystal.
    (b) varying the supply voltage to the oscillator.
    (c) varying the bias applied to the oscillator.
    (d) altering the setting of the thermostat controlling a heating element.

25. In order to receive morse telegraphy (A1) transmissions efficiently a beat frequency oscillator is employed to :

    (a) stabilise the intermediate frequency in a superheterodyne receiver.
    (b) beat with the local oscillator to produce sidebands.
    (c) produce an audio signal.
    (d) prevent key clicks being produced in the audio output.

26. With reference to single-sideband suppressed carrier mode of transmission which stage of the transmitter suppresses the carrier?:

    (a) the linear amplifier.
    (b) the balanced modulator.
    (c) the microphone pre-amplifier.
    (d) the sideband filter.

27. A product detector is commonly used for the reception of one of the following emissions:

(a) double sideband full carrier.
(b) frequency shift keying.
(c) frequency modulation.
(d) single sideband suppressed carrier.

28. Which meter would you use to measure the direct current drawn by a transistor type radio receiver?:

(a) a transistor tester.
(b) a permanent magnet moving coil shunted by a resistor.
(c) a permanent magnet moving coil with a capacitor in series.
(d) a field effect transistor (FET) type voltmeter.

29. Within which frequency band would you place the frequency of 3.550 Megahertz?:

(a) very high frequency (VHF)
(b) ultra high frequency (UHF)
(c) medium frequency (MF)
(d) high frequency (HF)

30. A capacitor of 33 microfarads is the same as :

(a) 33×10^{-6} farads.
(b) 33×10^{-12} farads.
(c) 33×10^{6} farads.
(d) 33×10^{12} farads.

31. The percentage of modulation of an amplitude modulated carrier is measured with?:

(a) a vacuum tube voltmeter.
(b) a cathode-ray oscilloscope.
(c) a standing-wave ratio meter.
(d) a high impedance multi-meter.

32. In order to convert a milliammeter to measure high voltage DC it is necessary to place:

(a) a resistor in series with the meter.
(b) a resistor in parallel with the meter.
(c) a rectifier in series with the meter.
(d) a capacitor in parallel with the meter.

33. Which of the details listed determines whether an amplifier stage is operating Class A?:

(a) power output.
(b) frequency response.
(c) harmonic distortion.
(d) bias arrangement.

34. The electrical resistance of a conductor increases when its:

(a) cross sectional area is increased.
(b) specific resistance is decreased.
(c) length is decreased.
(d) cross sectional area is decreased.

35. The unit of inductance is the:

(a) Maxwell.
(b) Henry.
(c) Farad.
(d) Morse.

36. Radio frequency waves travel in free space at a rate of:

(a) 300,000 metres per second.
(b) 300,000,000 metres per hour.
(c) 300,000,000 metres per second.
(d) 300,000,000 metres per minute.

37. The unit of capacitance is the:

(a) Farad.
(b) Henry.
(c) Gauss.
(d) Joule.

38. A yagi antenna may consist of a driven and reflector element, an additional element would most likely be:

(a) a refractor.
(b) a rejector.
(c) a radiator.
(d) a director.

39. The impedance of a radio frequency feeder line must match the antenna and the transmitter output in order to:

(a) maintain frequency stability.
(b) prevent fading of signals at the receiving station.
(c) prevent circular polarisation of the transmitting signal.
(d) obtain maximum transfer of power to the antenna.

40. The main object in using an audio output transformer in an amplifier is to:

(a) rectify the audio signal.
(b) match the impedance of the output stage to a loud speaker.
(c) step up the voltage applied to the loud speaker.
(d) change the frequency of the audio.

41. To convert alternating current to direct current, use is made of a:
(a) thermistor
(b) resonant LC circuit.
(c) diode.
(d) carbon resistor.

42. A quartz crystal may be used to stabilise the frequency of an Amateur transmitter due to:

(a) the piezoelectric effect.
(b) the reflections from its highly polished surfaces.
(c) its voltage regulating capabilities.
(d) its temperature regulating capabilities.

43. To assist a power transistor to operate within its temperature rating, use is made of:

(a) a thermostat.
(b) an evaporative type of cooler.
(c) a heat sink.
(d) a reverse current cut-out.

44. Harmonics are more likely to be produced when:
(a) a resonant circuit is detuned.
(b) a negative feed back is applied to an amplifier.
(c) a transistor is biased for class A operation.
(d) a sine wave is distorted.

45. Which is the correct ohms law equation to use when determining the current flowing in an electrical circuit?:

(a) $I = E/R$
(b) $I = ER$
(c) $I = R/E$
(d) $I = ER^{\circ}$

46. Which is the correct ohms law equation to use when determining the applied voltage to an electrical circuit?:

(a) $E = IR$
(b) $E = I^{\circ}R$

(c) E = R/I
(d) E = I/R

47. A capacitor has increased capacitance when:

(a) the distance between the plates is increased.
(b) the area of the plates is decreased.
(c) the dielectric constant of the material separating the plates is decreased.
(d) the distance between the plates is decreased.

48. Energy is transferred from the primary to the secondary of a transformer by the process of:

(a) mutual inductance.
(b) amplification factor.
(c) current gain.
(d) standing wave ratio.

49. In order to sustain oscillations in a transistor or valve type oscillator it is essential that:

(a) negative feed back be introduced from output to input.
(b) the oscillator be perfectly neutralised.
(c) the oscillator is followed by a buffer stage.
(d) positive feed back be introduced from output to input.

50. A mechanical filter, when used in the immediate frequency amplifier stage of a receiver improves the:

(a) selectivity.
(b) sensitivity.
(c) audio quality.
(d) bass response.

ANSWERS

1. C
2. A
3. C
4. B
5. C
6. A
7. D
8. C
9. A
10. A
11. D
12. B
13. C
14. A
15. D
16. C
17. B
18. A
19. D
20. A
21. C
22. B
23. A
24. A
25. C
26. B
27. D
28. B
29. D
30. A
31. B
32. A
33. D
34. D
35. B
36. C
37. A
38. D
39. D
40. B
41. C
42. A
43. C
44. D
45. A
46. A
47. D
48. A
49. D
50. A

DEPARTMENT OF COMMUNICATIONS
SAMPLE EXAMINATION FOR AMATEUR OPERATOR'S CERTIFICATE OF PROFICIENCY AND AMATEUR OPERATOR'S LIMITED CERTIFICATE OF PROFICIENCY

SECTION "M" (THEORY)

(Time Allowed — 1½ hours)

1. When two resistances are connected in series:
   (a) they must both have the same resistance value
   (b) the voltage across each must be the same
   (c) they must have different resistance values
   (d) there is only one path for current through both resistances.
2. In a diode the forward current increases when:
   (a) the anode voltage is made more positive
   (b) the anode voltage is made less positive
   (c) the collector voltage is made less negative
   (d) reverse bias is applied.
3. A power-line filter for rejecting radio frequency (RF) interference has:
   (a) RF coupling capacitors in series with the power line
   (b) RF chokes in shunt across the power line
   (c) 50 Hz chokes in series with the power line
   (d) RF bypass capacitors in shunt across the power line.
4. The most outstanding difference between a primary cell and a secondary cell is:
   (a) secondary cells are dry; primary cells are wet
   (b) secondary cells hold their charge longer than primary cells
   (c) secondary cells can be recharged; primary cells cannot
   (d) primary cells can be recharged; secondary cells cannot.
5. A heat sink is often used with transistors and semi-conductor diodes to:
   (a) decrease the forward current
   (b) increase the reverse current
   (c) prevent excessive junction temperature rise
   (d) compensate for excessive doping.
6. Measurement with a reflectometer shows that the forward power in a transmission line is 225 watts while the reflected power is 25 watts. What is the voltage standing-wave ratio (VSWR)?
   (a) 1 to 1
   (b) 2 to 1
   (c) 9 to 1
   (d) 10 to 1.
7. Ionisation in the ionosphere is caused primarily by the:
   (a) magnetic effect of the Earth
   (b) magnetic effect of the Sun
   (c) ultraviolet and other radiation from the Sun
   (d) rotation of the Moon

8. Which of the following L-type filters is the best band-stop filter?
   (a) series-resonant LC circuit in series with the load and parallel-resonant LC circuit in shunt
   (b) parallel-resonant LC circuit in series with the load and series-resonant LC circuit in shunt
   (c) series-resonant LC circuits in series and in parallel with the load
   (d) parallel-resonant LC circuits in series and in parallel with the load.
9. The best method of eliminating TV set front-end overload caused by a 160 metre through 10 metre amateur transmitter is to:
   (a) use a high-pass filter on the TV receiver
   (b) use a low-pass filter on the transmitter
   (c) install a wave-trap in the TV set's feedline
   (d) install sound bars on the TV set.
10. To check for harmonic radiation from a transmitter you might use a:
    (a) signal generator
    (b) wavemeter
    (c) thermocouple ammeter
    (d) signal tracer.
11. A tungsten filament measures 10 ohms with an ohmmeter. In a circuit with 100 volts applied, 2 amperes flow. The hot resistance of the filament equals:
    (a) 2 ohms
    (b) 10 ohms
    (c) 50 ohms
    (d) 100 ohms.
12. The diagonal lines that can appear on a TV screen because of radio transmitter interference are known as:
    (a) sound bars
    (b) cross hatching
    (c) transmission lines
    (d) harmonic lines.
13. In a series LC circuit, at the resonant frequency the:
    (a) current is minimum
    (b) voltage across C is minimum
    (c) impedance is maximum
    (d) current is maximum.
14. The internal resistance of a milliammeter must be very low in order to have:
    (a) high sensitivity
    (b) accuracy
    (c) maximum voltage drop across the meter
    (d) minimum effect on the current in the circuit.
15. Which of the following would be the most effective means of reducing harmonic generation in a power amplifer stage?
    (a) Class AB operation
    (b) Class AC operation
    (c) high negative bias
    (d) parasitic suppressors in the grid and anode leads.

16. A capacitance of .002 microfarad is the same as:
   (a) 20 picofarads
   (b) 200 picofarads
   (c) 2000 picofarads
   (d) 20,000 picofarads.

17. Which of the following classes of amplifier operation would **not** be suitable for amplification of an A3J emission?
   (a) Class B grounded grid
   (b) Class A
   (c) Class AB
   (d) Class C.

18. The collector-base circuit in a transistor amplifier circuit has:
   (a) forward bias at all times
   (b) reverse bias at all times
   (c) reverse bias for NPN but forward bias for PNP
   (d) reverse bias for PNP but forward bias for NPN.

19. At what part of the sunspot cycle would the night-time maximum usable frequency (MUF) be closest to the 7 MHz band?
   (a) at the sunspot maximum
   (b) at the sunspot minimum
   (c) the MUF never goes below the 14 MHz band
   (d) the sunspot cycle does not affect the 7 MHz band.

20. A two-tone test signal may be used to determine:
   (a) correct carrier balance
   (b) the degree of phase distortion in an amplifier
   (c) interelectrode capacitance
   (d) the degree of intermodulation distortion in a linear amplifier.

21. The third harmonic of a signal having a fundamental frequency of 7000 kHz is:
   (a) 2333 kHz
   (b) 16,333 kHz
   (c) 21,000 kHz
   (d) 28,000 kHz.

22. A suitable detector for the reception of A3J signals is the:
   (a) reactance modulator
   (b) ratio detector
   (c) discriminator
   (d) product detector.

23. In typical bipolar transistors, collector leakage current:
   (a) tends to increase with a rise in temperature
   (b) tends to decrease with a rise in temperature
   (c) is independent of temperature fluctuations
   (d) is non-existent.

24. A laminated iron core has reduced eddy-current losses because:
   (a) the laminations are stacked vertically
   (b) the laminations are insulated from each other
   (c) the magnetic flux is concentrated in the air gap of the core
   (d) more wire can be used with less DC resistance in the coil.

25. In VHF receivers a first IF of 10.7 MHz is commonly used. This is done to:
    (a) provide a high degree of adjacent channel selectivity
    (b) reduce noise generated in the receiver
    (c) achieve the high gain required
    (d) provide an adequate degree of image rejection.

26. The term "vertically polarised electromagnetic wave" refers to a wave in which the:
    (a) magnetic component oscillates vertically
    (b) electric component oscillates vertically
    (c) magnetic component has been eliminated
    (d) electric component has been eliminated.

27. Semiconductor material has:
    (a) high conductivity
    (b) low resistance
    (c) greater conductivity than an insulator
    (d) less conductivity than an insulator.

28. An amplifier has an input of 1 milliwatt and an output power of 1 watt. What is the stage gain in decibels?
    (a) 10 dB
    (b) 20 dB
    (c) 30 dB
    (d) 100 dB.

29. In a single conversion SSB transceiver, the receiver beat frequency oscillator could be used in the transmitter section as the:
    (a) heterodyne oscillator
    (b) carrier oscillator
    (c) audio preamplifier
    (d) side-tone generator for CW monitoring.

30. Which transistor circuit is best suited to supply a low impedance load?
    (a) emitter follower
    (b) grounded base
    (c) common emitter
    (d) common base.

31. Which of the following is a basic principle of oscillator operation?
    (a) modulation
    (b) neutralisation
    (c) negative feedback
    (d) positive feedback.

32. Selective fading of radio waves results from:
    (a) a combination of ground waves and sky waves
    (b) bending of line-of-sight waves
    (c) wave path variations with small changes in frequency
    (d) absorption of the ground wave signal.

33. For a frequency modulated transmitter to have a modulation index of 5 when the highest modulating audio frequency is 15 kHz, the peak deviation in kilohertz would have to be:

(a) 3
(b) 40
(c) 75
(d) 150.

34. An 0.2 microfarad capacitor will have a reactance of 1000 ohms at the frequency of:
(a) 800 Hz
(b) 1 Hz
(c) 1 MHz
(d) 8 MHz.

35. For a 1 volt range, a 50 micro-ampere movement with an internal resistance of 2000 ohms needs a multiplier resistance of:
(a) 1000 ohms
(b) 3000 ohms
(c) 18,000 ohms
(d) 50,000 ohms.

36. What determines the skip distance of radio waves?
(a) the frequency and the power level used
(b) the frequency used and the state of the ionosphere
(c) the effective radiated power
(d) the power level and mode of emission used.

37. Neutralisation of a transmitter power amplifier stage:
(a) improves the Q of the tank circuit
(b) prevents self oscillation within the amplifier
(c) prevents harmonic radiation
(d) cancels the effect of regeneration from feedback through the anode-cathode capacitance.

38. Audio rectification interference to hi-fi equipment is often cured by installing by-pass capacitors at the amplifier's speaker terminals. Which of the following capacitor values would be most suitable?
(a) 4.7 picofarads
(b) 4700 picofarads
(c) .47 microfarad
(d) 4.7 microfarads.

39. Automatic gain control (AGC) in a radio receiver provides:
(a) remote operation in a mobile capacity
(b) pre-set switching of frequencies on all bands
(c) constant audio output over a wide range of received signal levels
(d) constant oscillator frequency control.

40. A half-wave dipole antenna is centre-fed through a 300 ohm transmission line which is an electrical half wavelength long. The impedance of the dipole is 70 ohms, purely resistive. What is the impedance at the input end of the transmission line?
(a) 4 ohms
(b) 70 ohms
(c) 140 ohms
(d) 280 ohms.

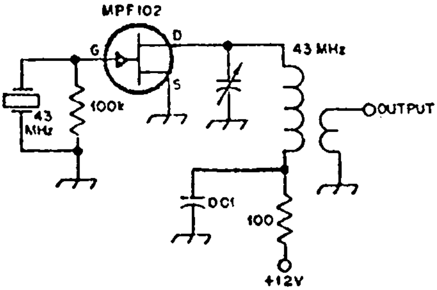
41. What is the purpose of the electronic unit known as a demodulator in a receiving system for radioteletype (RTTY)?
   (a) it prevents morse code signals from operating the teletype machine
   (b) it is needed because the receiver does not have enough power output to operate the teletype machine directly
   (c) it converts the incoming signal frequency to the receiver's intermediate frequency
   (d) it converts frequency-shift signals into direct current pulses for operating the teletype machine.

42. An overtone oscillator:
   (a) is used in a receiver filter for telegraphy (CW) reception
   (b) is one in which the frequency of operation is an approximate multiple of a lower frequency to which the crystal is cut
   (c) is designed to produce tone modulated output for two tone tests
   (d) is one in which the frequency of operation is a sub-multiple of the frequency to which the crystal is cut.

43. A push-pull audio-frequency amplifier is preferable to a single transistor stage because:
   (a) it is easier to couple it to the next stage
   (b) less input voltage is required
   (c) if one transistor fails, the other remains active
   (d) the even harmonics in the output are cancelled.

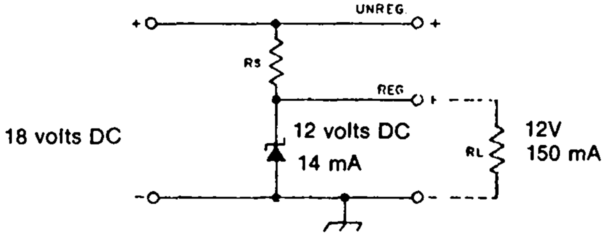
44. Which one of the following statements regarding amplifier configurations is correct?
   (a) the common-collector amplifier has the highest voltage gain
   (b) the common-collector amplifier has the highest power gain
   (c) for the common-emitter amplifier an increase in base voltage results in a decrease in collector voltage
   (d) the common-base amplifier has the highest input resistance.

45. The following circuit diagram represents:



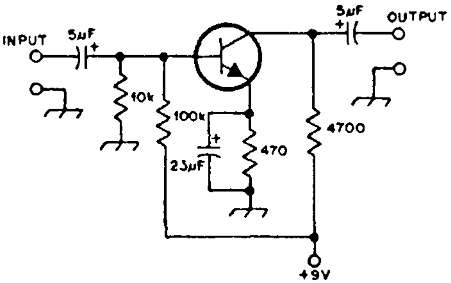
   (a) an overtone oscillator
   (b) a Colpitts oscillator
   (c) a Pierce oscillator
   (d) a Hartley oscillator.

46. The value of the series resistor Rs in the following diagram should be:



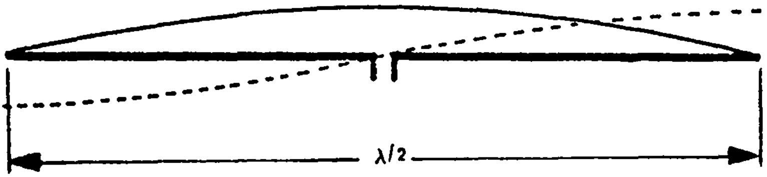
(a) 6 ohms ½ watt
(b) 6 ohms 1 watt
(c) 36 ohms ½ watt
(d) 36 ohms 1 watt.

47. The function of the 25 uF capacitor in the following diagram is to:



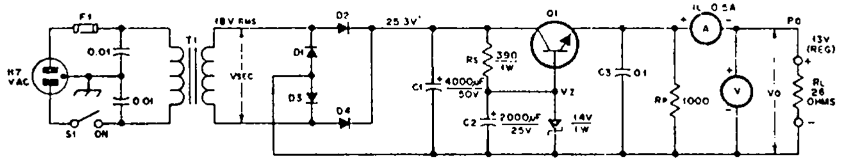
(a) ensure the emitter is always more negative than the base
(b) by-pass parasitic oscillations to earth
(c) ensure the emitter is always more positive than the base
(d) provide a low impedance path for the alternating component.

48. The diagram is a representation of a half-wave antenna. The solid curved line represents:



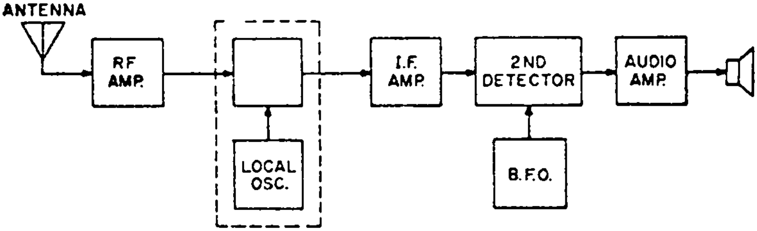
(a) voltage distribution
(b) impedance pattern
(c) current distribution
(d) radiation pattern.

49. The regulated power supply circuit shown below would not function correctly because:



(a) D1 and D2 are reverse connected
(b) the Zener diode is reverse connected
(c) an NPN transistor has been used
(d) a PNP transistor has been used.

50. The block that is not identified in the following diagram is the:



(a) beat frequency oscillator
(b) second oscillator
(c) limiter
(d) mixer.

ANSWERS

1. D
2. A
3. D
4. C
5. C
6. B
7. C
8. B
9. A
10. B
11. C
12. B
13. D
14. D
15. A
16. C
17. D
18. B
19. B
20. D
21. C
22. D
23. A
24. B
25. D
26. B
27. C
28. C
29. B
30. A
31. D
32. C
33. C
34. A
35. C
36. B
37. B
38. B
39. C
40. B
41. D
42. B
43. D
44. C
45. A
46. D
47. D
48. C
49. B
50. D

CLUB DIRECTORY

NAME OF CLUB	MEETING PLACE & TIME	CONTACT
N.S.W. Radio Clubs		
Amateur & Citizens Radio Club NSW DIVISION and States outside of Victoria	Novice & Licence Course 2 Griffith Ave East Roseville NSW 2069	Sam Voron, VK2BVS, Ph: (02) 407 1066 2 Griffith Ave East Roseville N.S.W. 2069
Albury & District Amateur Radio Club	Wodonga Show Grounds First and third Tuesday of each month at 7 pm.	Secretary, P.O. Box 294 Wodonga 3690
Armidale Radio Club	Armidale Police Boys' Club. Wednesday evenings at 7.30 pm.	Bill Laird, VK2BLA. 37 Kentucky Street. Armidale NSW 2350. Ph: (067) 72-4419. Or Max Schultz, VK2NIS. c/o New England Mobile Communications. Lynche's Road, Armidale NSW 2350.
Australian Ladies Amateur Radio Association	On field days or to suit members	Geraldine Plant, VK2NQI. P.O. Box 56, Kemp's Creek, 2171
Bathurst Amateur Radio Group	SES Headquarters, George St, Bathurst. Third Friday of the month at 8 pm.	
Blue Mountains Radio Club	Springwood Primary School. Every Friday evening at SPC and first Monday of each month at BPS at 8.00 pm.	Peter Willis, Ph: (047) 39-2203 or Terry Ryeland 38 Brock Road, Glenbrook 2773 Ph: 392551
Casino Amateur Radio Club	First Thursday of the month.	P.O. Box 404 Casino, 2470
Castle Hill RSL Radio Club	Castle Hill RSL Club, Castle St, Castle Hill. First Monday of the month at 8 pm.	Ian O'Toole, VK2ZIO, Ph: (02) 680 2112
Central Coast Amateur Radio Club	Clubrooms, Dandaloo St. Kariong NSW First and third Friday each month at 8.00 pm.	Secretary, Mrs. S.J. Wells, P.O. Box 238, Gosford, NSW 2250.
Coffs Harbour and District Amateur Radio Club	Orara High School. Wednesdays at 7 pm. (Except college vacations.)	P.O. Box 655, Coffs Harbour, 2450.
Crestwood Radio Club	16 Turon Avenue, Baulkham Hills Every Saturday evening 7.00 pm — 10.30 pm.	The Secretary, 16 Turon Avenue Baulkham Hills 2153 Ph: (02) 639-0267

Goulburn and District Amateur Radio Club	Education Centre. Taralga Road. North Goulburn. NSW. Monthly to suit members	Secretary, Bob Woodman. VK2EY, 38 Dixon Street. Goulburn NSW 2580 Ph: (48) 21 1020. or David Thompson VK2BOT. Ridge Street. Goulburn NSW 2580 Ph: (048) 21 5036.
Griffith Radio Club	To suit members As necessary	W. Marshallsea. VK2ADZ. 28 Probert Avenue. Griffith. NSW 2680 Ph: (069) 62 3718
Gunnedah and Districts Amateur Radio Group	Gunnedah Scout Hall. First Thursday of the month	"Womboyne", Kelvin 2380
Hornsby & Districts Amateur Radio Club	Hawkins Hall, Cnr. Sefton Rd & Lockenby Street, Normanhurst. First Wednesday of each month at 7.45 pm.	P.O. Box 362, Hornsby. 2077. David Ramsay. VK2YLX (02) 476 1048
Hunter Branch NSW Division WIA	Newcastle Technical College, First Friday of each month at 8.00 pm.	Secretary, Rodney Prout. VK2CN. 21 John St. Dudley. 2290.
Illawarra Amateur Radio Society	Wollongong Town Hall Meeting Room. Second Monday of each month at 7.30 pm.	Postal address: P.O. Box 1838. Wollongong 2500. President: Bill Clavert. VK2DJ. Ph: (042) 71 3569.
Killarney Heights Novice Radio Group	To suit members.	P.O. Box 439 Crows Nest. 2065
Liverpool & Districts Amateur Radio Club	State Emergency Services Hall, Christie St. Liverpool. Second Tuesday of the month at 7.30 pm. Weekly instruction classes — Novice licence Tuesdays at 7.30 pm. Youth Radio Scheme Saturdays at 10 am.	Nev Fenton. VK2ZBQ Ph: (02) 607 6261
Maitland Amateur Radio Club	1 Maize St, East Maitland. Friday evenings 7.00 pm to 9.00 pm.	P.O. Box 59. East Maitland NSW 2323. Ph: (049) 33 7725
Manly Warringah District Radio Club	Old RAAF Radar Station. Warringah Road. Beacon Hill. Wednesday evenings at 7.30 pm.	Secretary, P.O. Box 186. Brookvale. 2100. Or Phone: Geoff Myers (02) 98 0689 7/9 Sturdee Road, Dee Why.
Mid South Coast Amateur Radio Club	Quarterly, usually at a family picnic.	Frank Hill. VK2HQ, Milton. Ph: (044) 55 1077 or Jim Yalden. VK2YGY Ph: (044) 55 2043

North East Amateur Radio Group		Secretary, P.O. Box 511 Moree, 2400
North West Amateur Radio Club	As arranged to suit members.	Secretary, Greg Jcpson, VK2VPP, P.O. Box 133, Inverell, 2360.
Novice Amateur Radio Group	Wireless Institute Centre, 14 Atchison Street, Crows Nest. Each Saturday at 1.00 pm.	Peter Vernon, VK2PV Ph: (02) 371 7681.
Orange Amateur Radio Club	Condobolos High School, Icely Rd, Orange First Friday in each month at 7 pm. (Except during school vacation.)	Secretary, P.O. Box 1065, Orange, 2800.
Oxley Region Amateur Radio Club	Quarterly. (Schools: Monday nights at Port Macquarie High School.)	P.O. Box 712, Port Macquarie NSW 2444 Ph: (065) 83 4272 (AH)
Parkes Amateur Radio Club	Youth Centre. Currajong Street Parkes Tuesday evenings at 7.30 pm.	Jack Mowtell, VK2BMJ 247 Clarinda Street, Parkes NSW 2870. Ph: (068) 62 2010 (bus) 62 3410 (AH) or Tom Darcy, 308 Clarinda Street, Parkes, NSW 2870 Ph: (068) 62 2941 (bus) 62 1663 (AH).
St. George Amateur Radio Society	Assembly Hall, Primary School, Kingsgrove. First Wednesday of each month at 7.30 pm.	President, Noel Spratt VK2BSN. Ph: (AH) 525 0536. Secretary, Alan Pettiford, VK2BAX. Ph: (bus) 70 0661 (AH) 533 4515.
Summerland Radio Club	Kadina High School, Goonellebah. Every two months, second Friday.	P.O. Box 524, Lismore. 2480. Ph: (066) 21 7901.
Southern Highlands Amateur Radio Society		c/- Telephone Exchange, Bowral. 2576.
Sydney Chapter Quarter Century Wireless Association	North Sydney Anzac Memorial Club, Anzac Street, Cammeray. Second Wednesday of each month at 7.00 pm.	Brian Anderson, VK2AND; Harry Caldecott, VK2DA, at their call book addresses.
Sydney Technical College Amateur Radio Society	9th Floor, (Tower Room) Building, 38/39 Railway Square (Temporarily inactive)	Arthur Brown, VKZ1K 26 Winifred Avenue, Epping 2121 Ph: 862 935
Sydney University Amateur Radio Club	Sydney University Every second week during term. Consult "Daily Bull" for details of time.	Secretary, Box 398. Wentworth Building, Sydney University, NSW 2006

Tamworth Amateur Radio Club	Tamworth SES Headquarters, Marius Street, Tamworth. Second Wednesday of each month 7.30 pm.	Les Keppie, P.O. Box W107 West Tamworth. Ph: (067) 68 0268
Taree Radio Club	Classes held at Taree Technical College. Wednesday evenings at 7.00 p.m.	Geoff Hunziker, VK2BGF, 17 Kolang Street, Old Bar, NSW 2430.
Tumut and District Radio Club	Tumut High School, Dalhunthy Street, Tumut. Wednesday evenings at 7.30 pm.	A. G. Dean, Lockhart Street, Adelong, 2729. Ph: 46 2181 (AH).
University of NSW Amateur Radio Society	Room 601 Electrical Engineering Building. Daily from 1.00 pm to 2.00 pm.	Chris Simeonoff, VK2ZAX, Ph: (02) 46 6217
Wagga Amateur Radio Club	Wagga Rescue Club Headquarters, Bolton Street, Wagga. Last Friday of each month at 8.00 pm.	Secretary, P.O. Box 71, Koringal, 2650.
Waverley Amateur Radio Club	1/6 Blenheim Street, Bondi Junction. Third Thursday of each month at 8.00 pm.	W. Pearce, 5 Spencer St. Rose Bay, NSW 2029.
Western Suburbs Amateur Radio Club	Second and fourth Tuesday 7.30 pm.	P.O. Box 151, Yagoona, 2199.
Westlakes Radio Club	Club rooms, York Street, Teralba. Each Saturday afternoon and Wednesday evening.	Secretary, Eric Brockbank, VK2ZOP, P.O. Box 1, Teralba, NSW 2284. Club Ph: (049) 58 1588.

Victorian Radio Clubs:

Australian Ladies Amateur Radio Association (ALARA)	Monthly in members' homes.	P.O. Box 216 Ballarat East, 3350.
Ballarat Amateur Radio Group	Regional Education Centre, Hopetoun St, Ballarat. First Sunday of each month at 9.30 am.	P.O. Box 216, Ballarat East, 3350.
Benalla District Radio Club	Benalla High School. First Friday of each month at 8.00 pm.	Secretary, Ian Connor, VK3NUU, or Rodney Johnstone, VK3KAM. P.O. Box 402, Benalla, Vic. 3672.
Disabled Amateur Radio Club	79-87 Buckhurst St. Sth. Melbourne 3205. Second and fourth Monday each month at 7.00 pm.	VK3ZZ Ph: 699 1888

Djerriwarah Amateur Radio Club	Melton Technical School, Wilson's Rd., Melton South. General meeting: first Tuesday of month. Novice classes and informal meetings: all other Tuesdays at 7.30 pm.	P.O. Box 29, Melton South. 3338.
Eastern and Mountain District Radio Club	General meetings in the Willis Room of the Library, Branch meetings in the Coffee Shop, Nunawading Civic Centre, Maroondah Highway, Nunawading. General meeting first Friday of each month and Branch meeting on other Fridays commencing at 8.00 pm.	Secretary, P.O. Box 87, Mitcham. Vic. 3132. Ph: (03) 725 6642.
Eastern Zone WIA Victorian Division	Gippsland Institute of Higher Education, Churchill, Vic. Last Friday of every third month (commencing January) at 7.30 pm.	R. Price, VK3AWQ, 5 St. Kilda St. Inverloch, Vic. 3996. Ph: (056) 74 1351.
Frankston & Mornington Peninsula Amateur Radio Club	Monterey Technical School, Silvertop Crescent, North Frankston. Second and fourth Friday in the month at 8 pm.	Secretary, FAMPARC, P.O. Box 38, Frankston 3199.
Geelong Amateur Radio & TV Club	Club Rooms, Storrer St., East Geelong. Each Friday night at 8.00 pm.	Secretary, P.O. Box 520, Geelong. Vic. 3220. or Alan Bradley, VK3LW. Ph: (052) 43 7550.
Gippsland Gate Radio Club	Heyington & Titcher Roads Dandenong. Second and Fourth Friday each month.	Lionel Curling Ph: 88 3710.
Ladies Amateur Radio Association	As arranged to suit members. Saturday afternoon once a month in Melbourne, as arranged to suit members in other states.	LARA. C/- 412 Brunswick St. Fitzroy, Vic. 3065.
Mildura Amateur Radio Club	8 Rolun Ct., Irymple. First Wednesday of each month at 8 pm.	
Moorabbin & District Radio Club	Combined Clubs Hall, Turner Rd. Highett. Vic. First and third Friday of month — Natter night at 8.00 pm Second Friday of month — 144 MHz hidden transmitter hunt, commencing at 8 pm Third Friday of month — General meeting at 8 pm.	Secretary, P.O. Box 88, East Bentleigh, 3165.

Northcote District Radio Club		P.O. Box 29, Northcote, 3070.
North Western Zone of WIA		Mrs. M. Syme, Irymple, 3498.
Radio Amateurs' Old Timers Club		Secretary, P.O. Box 50, Point Lonsdale, 3225.
Shepparton and District Amateur Radio Club	Mechanics Institute Hall, 225 Wyndham St., Shepparton. First Wednesday of each month at 7.30 pm.	Secretary, P.O. Box 692, Shepparton, 3630.
Southern Peninsula Amateur Radio Club	Rosebud Primary School. First and third Mondays of each month at 7.30 pm.	
Swan Hill & District Radio Club	Room 20, Swan Hill Technical School. First Thursday of month.	Secretary, Peter Forbes (050) 37 2591.
Warrnambool Amateur Radio Club	Warrnambool Buffalo Lodge Rooms, Cnr. Kariot and Kelp Sts. Warrnambool. First and third Wednesdays of each month at 8.00 pm.	Geoff Tonkin, 14 Skiddaw Cr., Warrnambool, Vic. 3280.
Western Suburbs Radio Club	Melbourne Caravan Park, 265 Elizabeth St., East Coburg, Vic. First Friday of each month (except January), at 8.00 pm.	Neil May, VK3VZY, 7/24 Blyth St., Brunswick, 3056. Ph: (03) 380 5810.
Wimmera Amateur Radio and Electronics Club	20 Wawunna Rd. Horsham, Victoria. Each Monday night — novice classes, films, excursions, construction projects.	Henry Gibson, 4 Iris Street, Horsham, 3400.
Queensland Radio Clubs:		
ABC (Q) Radio Club	c/o ABC, 600 Coronation Drive, Toowong, Qld. 4066.	
Ashgrove Boy Scout Radio Club	64 Fulcher Rd., Ashgrove. Qld. 4060.	
Brisbane Amateur Radio Club	State Emergency Service "C" Group Headquarters Cnr. School & Ipswich Rds Yeronga. Second and fourth Friday of each month.	P.O. Box 310 Mt. Gravatt, 4122.
Brisbane North Radio Club	W. H. Hooper Centre, State School, Wavell Heights. Second and fourth Fridays of each month at 7.30 pm.	P.O. Box 78, Chermside, 4032.
Brisbane VHF Group	Newmarket State High School, Banks Street, Newmarket. Fourth Wednesday of each month at 7.30 pm.	P.O. Box 911, Fortitude Valley Brisbane, 4006.

Brisbane (South) Technical College Radio Club	91 Merrivale St., South Brisbane. Qld. 4101.	
Bundaberg Amateur Radio Club	Norvel Primary School Library. Fourth Wednesday of month at 7.30 pm.	P.O. Box 129, Bundaberg. Qld. 4670.
Cairns Amateur Radio Club	State Emergency Service Building, McNamara St., Cairns. Second Thursday of each month at 8 pm.	Secretary, Anne Benson, VK4NXK, P.O. Box 1426, Cairns, Qld. 4870. Ph: 53 4115.
Darling Downs Radio Club	Toowoomba Education Centre, Baker St., Darling Heights, Last Friday of each month (except Dec.) at 7.30 pm.	Secretary, P.O. Box 3014 Town Hall, Toowoomba, 4350.
Gladstone Amateur Radio Club	Gladstone Education Centre, Central State School, Auckland St. Third Tuesday of each month at 9.30 pm.	P.O. Box 1030 Gladstone, 4680.
Gold Coast Amateur Radio Society	S.C.W.O. Room (adjoining Public Library), Lawson St., Southport. Second Friday of each month at 8.00 pm.	Secretary, P.O. Box 588, Southport. Qld. 4215.
Ipswich & District Radio Club	Club Rooms, Deebing St. Denmark Hill. First and third Wednesday at 7.30 pm.	Secretary, P.O. Box 250, Ipswich 4305 or PRO Bill Jehn, Ph: (07) 281 3629.
Mackay Amateur Radio Club	State Emergency Service Building, Swayne St., North Mackay. Qld. Fourth Thursday of each month at 8.00 pm.	Ron Kerle, VK4EN, 32 Evan St, Mackay, 4740. Allan Mackenzie, VK4ZAN, 4 Laird St. Nth. Mackay 4740. Ph: (079) 57 8936. Neil McIntyre, VK4NAP, 6 Harris St., Beaconsfield 4740. Ph: (079) 511 381.
Maryborough Amateur Radio Club	TAFE College Rooms, Old Boys High School, Sussex St., Maryborough. First Monday of each month at 7.30 pm.	Col Paton, VK4NBP, 225 Pallas St. Maryborough. Qld. 4650. Ph: (071) 22 1090.
Mt. Isa Amateur Club	Meetings held on casual basis at various locations.	Secretary, P.O. Box 1715, Mt. Isa, 4825.
Queensland Branch HQ Boy Scouts Radio Club	Baden Powell Park, Samford. First Sunday of each month at 9.30 am to 1.00 pm.	Les Weller, 110 Cardiff St., Darra, 4076.
RAR (1st) Radio Club		Lavarack Barracks, Townsville, Qld. 4813.

Redcliffe Radio Club	Redcliffe Education Centre, Henzell St. Redcliffe. Mondays 7.30 to 9.30 pm.	Hon Secretary, P.O. Box 20, Woody Point. Qld. 4019. Ph: (07) 284 6098.
Redland Radio & Electronics Society		P.O. Box 161, Cleveland, Qld. 4163.
Rockhampton District Scout Radio Club		P.O. Box 383, Rockhampton, 4700. VK4OB.
Roma and District Amateur Radio Society	Home Centre St. Johns School, McDowall St., Roma. Third Friday of each month at 7.45 pm.	Secretary, Noel Teufel Ph: (074) 22 2533 (BH).
South East Queensland Amateur Television Group	Hooper Centre, Wavell Heights School, Keiran St., Chermside. First Friday of each month.	Tom Ivins, VK4ABA, P.O. Box 3, Chermside, 4032. Ph: (07) 264 1278.
South East Queensland Teletype Group	Library, St. Brendan's School, Hawtree St., Moorooka. First Friday of each month at 8 pm.	
Sunshine Coast Radio Group	Bli Bli Public Hall. First Tuesday each month.	P.O. Box 80, Nambour, 4560. George VK4WQ. Ph: (071) 45 7262.
Townsville Amateur Radio Club	State Emergency Headquarters, Green St., West End, Townsville. First Tuesday of each month at 8 pm.	Secretary, TARC, P.O. Box 964, G.P.O. Townsville. Qld. 4810.
University of Queensland Amateur Radio Club	Biological Science Building, University of Qld., St. Lucia. Qld. 4067.	
WIA Central Queensland Branch	North Rockhampton High School. Third Friday of each month at 7.30 pm.	Secretary, WIA C.Q. Branch P.O. Box 496, Rockhampton, 4700.
Windsor YMCA Radio Club	2/32 Farrington Rd., Alderley. Qld. 4051.	VK4AYM
Yeronga Technical College Radio Club		P.O. Box 45, Yeronga. Qld. 4104.

South Australia Clubs:

Adelaide University Radio Club	Clubroom top of Civil Engineering Building. Adelaide University. Thursdays 1.00 pm to 2.00 pm during University term. First and third Monday of the month at 8.00 pm.	Secretary, Radio Club. c/o SAUA Office, Adelaide University. 5001.

Elizabeth Amateur Radio Club	Elizabeth East Sea Scout Hall. Hornett Crescent. Elizabeth East. Sth. Aust First Saturday each month at 8.00 pm.	President — Tony Cooling. Ph: (08) 255 2249. Secretary — Bill Thomas, Ph: (08) 258 6070. P.O. Box 8. Elizabeth. 5112.
Gulf Radio Group	Third Tuesday every month.	P.O. Box 145, Whyalla, 5600.
Lower Eyre Peninsula Amateur Radio Club	SES, Robertson Rd., Port Lincoln. First Wednesday of every month.	J. Kleinrahm, VK5ALM, P.O. Box 937, Port Lincoln, 5606.
Lower Murray Amateur Radio Club	F.E.C., Murray Bridge. Every Wednesday night at 8 pm.	P.O. Box 234, Murray Bridge, 5253.
Naracoorte Amateur Radio Club	Further Education Building Naracoorte. Fourth Friday of month at 8 pm.	
Port Pirie Amateur Radio Club	Club Rooms at the Airport, Port Pirie. First Friday of each month at 7.30 pm.	Secretary, Graham Phillis, VK5AGP, 413 The Terrace. Port Pirie, 5540. Ph: (086) 32 1627.
Sacred Heart College Radio Club	Sacred Heart College. Brighton Road, Somerton Park. Each Friday at 7.00 pm.	L. Powning, VK5ZLO. 6 Oxford Street, Somerton park.

Scout Radio Clubs in South Australia:

VK5KR — Blackforest Scout Group. Monday nights.	Enquiries VK5TY
VK5ZS — St. Mary's Scout Group Thursday nights.	Enquiries L. Possingham. through Scout H.Q.
VK5ABP — 1st Salisbury Scout Group	Enquiries E. (Tug) Wilson through Scout H.Q.
VK5BPN — Northbridge Scout Group	Enquiries Mrs. Dianne Stevens, 26 Anthony Road, Para Vista. 5093.
VK5BPT — Tea Tree Gully Scout Group	Enquiries VK5ZAH.
VK5AFV — Fullarton Venturer Unit	Enquiries Jerry Buxton, Box 159. Kingswood. 5062.
VK5BP — Headquarters campsite.	"Russell's Hut", Woodhouse Estate, Spring Gully Road. Stirling East.

ENQUIRIES:
VK5DQ, Box 100, Echonga, 5153.

SCOUT H.Q. ADDRESS:
Box 189, Stirling, 5152.

South Coast Amateur Radio Club	Community Centre, Baden Terrace, O'Sullivan Beach, S.A. (adjacent Netball Courts). Tuesday and Thursday evenings 7.30 pm to 9.30 pm.	President, P. J. Wilson, 22 Duval Drive, Morphett Vale. Ph: (08) 382 0313 (AH)

South-East Radio Group	Clubrooms. Olympic Park. Third Friday of the month.	P.O. Box 1103. Mt. Gambier, 5290. Ph: (087) 25 3287. Tony VK5NVF.
Woomera Amateur Radio Club	Clubhouse. Killara Ave., Woomera. each Wednesday night at 7 pm.	P.O. Box 538, Woomera. 5720.

Western Australia Clubs:

Busselton Amateur Radio Club	Scout Hall, Busselton. First Tuesday of each month at 8 pm.	Secretary, Box 282. Busselton. 6280. Ph: 52 1173.
Mt. Tom Price Amateur Radio Club		D. Meads. VK6ZRM, 330 Palm St., Tom Price. 6751
North West Radio Society		P.O. Box 283, Port Hedland. 6721.
Paraburdoo Amateur Radio Club		P.O. Box 95 Panaburdoo. 6754.
Perth Radio League of W.A.		Box N1102. G.P.O. Perth. 6001.
Southern Electronics Group	242 Serpentine Road Albany. First Monday of each month at 8 pm.	Mrs C. Reitza 6 Jeffries Street Albany 6330. Ph: (048) 41 1959.
West Australia Amateur Radio and TV Club	Murdoch University. Each Friday night at 7.30 pm.	P.O. Box 576B. Belmont, 6014.
WA Institute of Technology Amateur Radio Club	Room 711A (top floor) Architecture Building, WAIT, Bentley 8 pm Wednesdays.	Box 78 Students Guild. WAIT Hayman Rd., Bentley. 6102.
WA VHF Group	Wireless Hill Museum Almondbury and McCallum Roads. Andross. Fourth Monday of each month at 8 pm	P.O. Box 189 Applecross 6153 David Laws Ph: (09) 64 1558

Northern Territory:

Alice Springs Community College Radio Club	Room 45. Alice Springs Community College, Wills Terrace. Monday evenings each week.	P.O. Box 795 Alice Springs N.T. 5750.
Darwin A.R.C.	East Point. First Monday of each month at 8 pm.	Peter Dodd. Ph: 89 1345.

Tasmanian Radio Clubs:

Northern Branch of WIA	34 Bourke Street, Launceston. Second Friday of each month.	The Secretary. P.O. Box 275, Launceston, 7520. Ph: Andre Everts 27 3008.
North Western Branch of WIA	Penguin High School. Every second Tuesday at 7.30 pm.	P.O. Box 194 Penguin, 7316.
Southern Branch of WIA	SES. Melville St., Hobart First Wednesday of each month.	P.O. Box 123, Sandy Bay, 7005 Ph: Harvey Skegg 47 6674.

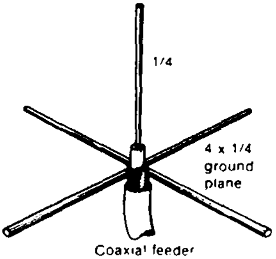
DATA SECTION

ANTENNAS

BASICS

The basic horizontal half wave aerial (½ λ) In practice, the physical length required for resonance is reduced by a factor of 0 95 (0 95 x ½ λ) due to the effect of insulators and nearby objects A simple formula for the practical half wave aerial is 143/F (MHz) metres At resonance the induced voltage V will be maximum at the ends of the aerial (high impedance) while the current I will be maximum at the centre

The basic Marconi aerial is a quarterwave vertical with the lower end close to the ground and it is used mainly on the lower frequencies If this aerial is erected over a perfectly conducting ground then an image of the aerial is formed which simulates a half-wave aerial In practice the 'perfect' earth is formed from a number of long wires (radials) laid on or just under the surface of the earth

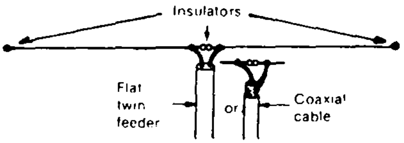


It is not necessary for the aerial wire to be physically the correct length for a particular frequency or wavelength It can be made shorter or longer electrically to achieve the same state of resonance by using an aerial tuning unit (a t u)

At higher frequencies such an aerial is commonly mounted well above earth and relies upon λ/4 radials entirely for its reflecting "earth plane" Such an aerial is known as a ground-plane

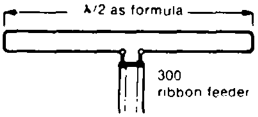
HALF WAVE DIPOLE

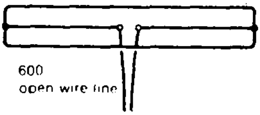
As the impedance at the centre of a half wave aerial is approximately 70 ohms, flat twin or coaxial feeders will provide a good impedance match to the aerial ensuring maximum signal transference The aerial, length calculated from the formula given, is cut at the centre and an insulator inserted the wires of the feeder being connected either side of the insulator



FOLDED DIPOLE

The folded dipole will transform the input impedance by a factor of 2^2 or 4 x 70 = 280 ohms so that it can be fed with a flat ribbon feeder of 300 ohms impedance provided the wires forming the folded dipole are the same diameter If a three-fold dipole is used the input impedance will be 70 x 3^2 = 630 ohms which will provide a good match to an open line feeder





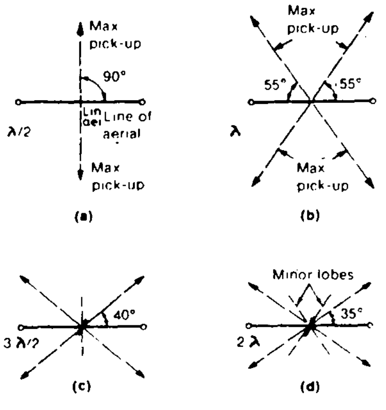
RODS AND WHIPS

For the unit dweller often without access to a roof or loft space, the only answer may be a vertical rod aerial 3 or 4m long made from aluminium or copper tubing An a t u is essential here to bring the aerial to resonance on the various bands Being very short this aerial will perform better on the higher frequency bands such as 10 and 15m A commercial whip aerial, with a base-mounting insulator of the type intended for mobile use can also be useful in this situation

DIRECTIVITY

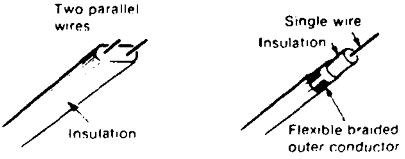
Signal pick-up of a half-wave aerial is maximum at right angles to the line of the wire (a) If the wire is one wavelength long maximum pick-up is from four directions (b) By choosing the right length of aerial and adjusting its orientation the maximum pick-up lobes can be made to cover all the land areas of the world

Longer aerials result in the appearance of minor lobes (c) and (d) which reduce directivity and improve all round coverage With an aerial many wavelengths long maximum reception is along the line of the wire



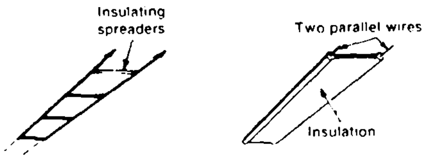
FEEDERS

Since the aerial should be located in the clear and generally as high as possible to produce maximum signal strength it is necessary to use a feeder to connect the aerial to the receiver Low impedance feeders may be flat twin (a), coaxial (b) or flat ribbon (d) High impedance feeders consist of two wires spaced apart by insulators every foot or so (c)



(a)
Nominal impedance
70-80 ohms

(b)
Nominal impedance
50-80 ohms

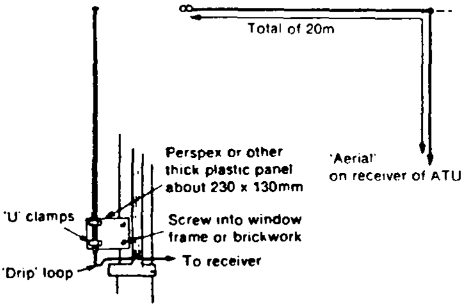


(c)
Typical impedance
600 ohms

(d)
Nominal impedance
240-300 ohms

LONG WIRE

A long length of copper wire, with one end connected to the receiver, is probably the most commonly used aerial. For best results it should be erected out of doors. The inverted "L" aerial is a good all-round performer especially if the vertical section can be 7m or more long. If the overall length is around 20m it will function well on the amateur bands without an aerial tuning unit but an a t u will make it even better. The combination of horizontal and vertical polarisation will help with DX signals where the received signal's polarisation can vary considerably from minute to minute

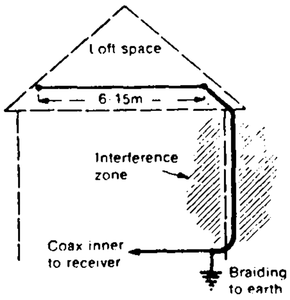

Total of 20m
Perspex or other thick plastic panel about 230 x 130mm
'Aerial' on receiver of ATU
'U' clamps
Screw into window frame or brickwork
To receiver
'Drip' loop

INDOOR

A long wire aerial can be erected in restricted loft spaces and inside roofs even if it means draping it round the rafters! If electrical noise is a problem then the lower part of the aerial can be a length of coaxial cable with the outer screen connected to the receiver chassis or earth

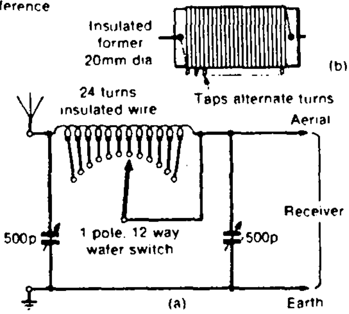
A similar aerial can be strung around a room and even quite a small room will enable a 12 metre length to be used

One convenient form of aerial can be obtained by using the coaxial cable of a TV aerial the outer braiding being connected to the aerial socket of the receiver. Important! — disconnect the TV aerial from the TV set before using it in this form



AERIAL TUNING UNIT

For best results an end-fed wire aerial or rod aerial should be matched to the receiver input circuit with an Aerial Tuning Unit (a). The inductor (b) is wound making a loop every other turn the loops then being soldered to the switch tags. Fit each tuning capacitor with a calibrated knob or dial and number the switch positions. Adjust the capacitors and switch position for maximum signal strength noting that the three adjustments re very much interdependent. Log dial and switch readings for future reference



YAGI

The most common version of the parasitic aerial array, the Yagi, will be familiar to all in its application to v h f and u h f TV and to v h f f m sound reception. Its basic form, the "H", is formed by adding a single rod to a half-wave dipole, spaced some small fraction of a wavelength from it. By making the rod slightly longer than the dipole, it acts as a reflector, modifying the response pattern to a cardioid (heartshape) pattern. In practice this is not a perfect cardioid, and there will be an unwanted rear lobe

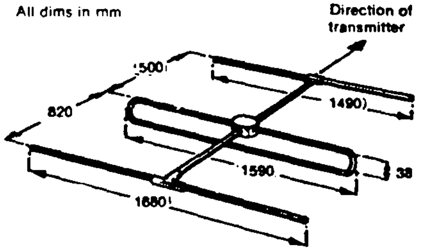
Adding a second rod, slightly shorter than the dipole, on the opposite side to the reflector, will reinforce and narrow the main lobe of the response pattern. A 3-element Yagi suitable for v h f f m sound reception is shown. The frequency of maximum response if 95MHz

Further directors may be added in front of the first, each slightly improving the gain of the aerial array, up to a limit of about 36 elements, after which no significant increase is obtained

Adding parasitic elements reduces the impedance of the dipole, as seen by the feeder, and a folded dipole is frequently used to help to compensate for this

V.H.F. YAGI FOR F.M. RADIO 88-108 MHz

All dims in mm



WIRE GAUGES AND WINDING DATA

This table presents the nominal diameter and resistance (to four significant figures) of bare copper wire in various gauges. The gauges are the Brown and Sharpe gauge (B&S, also known as the American Wire Gauge, AWG), the Standard Wire Gauge (SWG), and the metric gauge.

The data are given in both imperial and metric units. The diameter in the imperial units is expressed in mils, a mil being 1/1000in.

The resistance would be within plus or minus 2% at 20°C but varies with temperature. The resistance changes approximately 0.4% for each °C change in temperature, increased temperature giving increased resistance.

B&S SWG GAUGES		Metric mm	Diam mils	Ohms per 1,000ft	Diam mm	Ohms per km
—	—	4.500	177.2	0.3304	4.500	1.084
—	7	—	176.0	0.3348	4.470	1.098
6	—	—	162.0	0.3951	4.116	1.296
—	8	—	160.0	0.4051	4.064	1.329
—	—	*4.000	157.5	0.4182	4.000	1.372
7	—	—	144.3	0.4982	3.666	1.635
—	9	—	144.0	0.5001	3.658	1.641
—	—	3.550	139.7	0.5310	3.550	1.742
8	—	—	128.5	0.6282	3.265	2.061
—	10	—	128.0	0.6330	3.251	2.077
—	—	*3.149	124.0	0.6740	3.149	2.212
—	11	—	116.0	0.7707	2.946	2.529
9	—	—	114.4	0.7821	2.906	2.599
—	—	2.800	110.2	0.8534	2.800	2.800
—	12	—	104.0	0.9588	2.642	3.146
10	—	—	101.9	0.9989	2.589	3.277
—	—	*2.500	98.42	1.070	2.500	3.512
—	13	—	92.00	1.225	2.337	4.020
11	—	—	90.74	1.260	2.305	4.134
—	—	2.240	88.18	1.333	2.240	4.375
12	—	—	80.81	1.588	2.053	5.210
—	14	—	80.00	1.658	2.032	5.440
—	—	*2.000	78.74	1.673	2.000	5.488
—	15	—	72.00	2.001	1.829	6.563
13	—	—	71.96	2.003	1.828	6.572
—	—	1.000	70.87	2.065	1.800	6.775
14	—	—	64.08	2.525	1.628	8.284
—	16	—	64.00	2.532	1.626	8.307
—	—	*1.600	62.99	2.617	1.600	8.575
15	—	—	57.07	3.184	1.450	10.47
—	17	—	56.00	3.307	1.422	10.85
—	—	1.400	55.12	3.414	1.400	11.20
16	—	—	50.82	4.016	1.291	13.18
—	—	*1.250	49.21	4.282	1.250	14.05
—	18	—	48.00	4.501	1.219	14.77
17	—	—	45.26	5.064	1.150	16.61
—	—	1.120	44.09	5.333	1.120	17.50
18	—	—	40.30	6.385	1.024	20.95
—	19	—	40.00	6.482	1.016	21.27
—	—	*1.000	39.37	6.691	1.000	21.95
—	20	—	36.00	8.002	0.9144	26.25
19	—	—	35.89	8.051	0.9119	26.41
—	—	0.9000	35.51	8.222	0.9000	27.10
—	21	—	32.00	10.13	0.8128	33.23
20	—	—	31.96	10.15	0.8120	33.30
—	—	*0.8000	31.50	10.45	0.8000	34.30
21	—	—	28.46	12.80	0.7231	41.99
—	22	—	28.00	13.23	0.7112	43.40
—	—	0.7100	27.96	13.27	0.7100	43.65
22	—	—	25.35	16.14	0.6440	52.95
—	—	*0.6300	24.80	16.85	0.6300	55.31
—	23	—	24.00	18.00	0.6096	59.07
23	—	—	22.57	20.36	0.5734	66.80
—	—	0.5600	22.04	21.33	0.5600	70.00
—	24	—	22.00	21.43	0.5588	70.30
24	—	—	20.10	25.67	0.5107	84.22
—	25	—	20.00	25.93	0.5080	85.06
—	—	*0.5000	19.69	26.76	0.5000	87.81
—	26	—	18.00	32.01	0.4572	105.0
25	—	—	17.90	32.37	0.4548	106.2
—	—	0.4500	17.72	33.04	0.4500	108.4
—	27	—	16.40	38.56	0.4162	126.5
26	—	—	15.94	40.81	0.4050	133.9
—	—	*0.4000	15.75	41.82	0.4000	137.2
—	28	—	14.80	47.35	0.3759	155.3
27	—	—	14.20	51.47	0.3608	168.9
—	—	0.3550	13.97	53.10	0.3550	174.2
—	29	—	13.60	56.07	0.3454	184.0
28	—	—	12.64	64.90	0.3211	212.9
—	—	*0.3150	12.40	67.45	0.3150	221.2
—	30	—	12.40	67.45	0.3150	221.2
—	31	—	11.60	77.07	0.2946	252.9
29	—	—	11.26	81.83	0.2861	268.5
—	—	0.2800	11.02	85.34	0.2800	280.0
—	32	—	10.80	88.91	0.2743	291.7
30	—	—	10.03	103.2	0.2548	338.6
—	33	—	10.00	103.7	0.2540	340.2
—	—	*0.2500	9.842	107.0	0.2500	351.2
—	34	—	9.200	122.5	0.2337	402.0
31	—	—	8.928	130.1	0.2268	426.8
—	—	0.2240	8.819	133.3	0.2240	437.5
—	35	—	8.400	147.0	0.2134	482.2
32	—	—	7.950	164.1	0.2020	538.4
—	—	*0.2000	7.874	167.3	0.2000	548.8
—	36	—	7.600	179.5	0.1930	589.1
—	—	0.1800	7.087	206.5	0.1800	677.5
33	—	—	7.080	206.9	0.1799	678.8
—	37	—	6.800	224.3	0.1727	735.8
34	—	—	6.305	260.9	0.1602	856.0
—	—	*0.1600	6.299	261.4	0.1600	857.5
—	38	—	6.000	288.1	0.1524	945.1
35	—	—	5.615	329.0	0.1427	1079
—	—	0.1400	5.512	314.4	0.1400	1120
—	39	—	5.200	383.5	0.1321	1258
36	—	—	5.000	414.8	0.1270	1361
—	—	*0.1250	4.921	428.2	0.1250	1405
—	40	—	4.800	450.1	0.1219	1477
37	—	—	4.453	523.1	0.1131	1716
—	—	0.1120	4.409	533.3	0.112	1750
—	41	—	4.400	535.7	0.1118	1757
—	42	—	4.000	648.2	0.1016	2127
38	—	—	3.965	659.6	0.1007	2164
—	—	*0.1000	3.937	669.1	0.1000	2195
—	43	—	3.600	800.2	09144	2625
—	—	.0900	3.551	822.2	0900	2710
39	—	—	3.531	831.8	08971	2729
—	44	—	3.200	1013	08128	3323
—	—	*0800	3.150	1045	.0800	3430
40	—	—	3.145	1049	07990	3442
41	—	—	2.801	1323	07115	4341
—	—	.0710	2.795	1327	0710	4355
42	—	—	2.494	1669	06336	5476
—	—	0630	2.480	1685	0630	5531
—	46	—	2.400	1800	06096	5907
43	—	—	2.221	2104	05643	6903
—	—	0560	2.204	2133	0560	7000
—	47	—	2.000	2593	05080	8506
44	—	—	1.978	2654	.05025	8707
—	—	*0500	1.969	2676	0500	8781

*First preference values

WINDING DETAILS

B&S No.	Turns per inch Enamelled	SWG No.	Turns per inch Enamelled	Diam mm	Turns per cm Enamelled
8	7.65	10	7.63	4 500	2 158
9	8.58	11	8.33	4 000	2.423
10	9 61	12	9 26	3 550	2 720
11	10.7	13	10.42	3.150	3 060
12	12.0	14	11.90	2 800	3 440
13	13.5	15	13.25	2 500	3.840
14	15.1	16	14 81	2 240	4.280
15	16.9	17	16.95	2.000	4 780
16	18.9	18	19.72	1.800	5.290
17	21.2	19	23.47	1.600	5 940
18	23 7	20	25.97	1.400	6 760
19	26.5	21	29.15	1.250	7.540
20	29.5	22	33.33	1 120	8.390
21	33.1	23	38 91	1.000	9.360
22	37.0	24	42 37	0.900	10 360
23	41.4	25	46 51	0.800	11 610
24	46 5	26	51.55	0.710	13.030
25	52.0	27	56.50	0.630	14.620
26	58.4	28	62 50	0.560	16.360
27	65.3	29	67.57	0.500	18 240
28	73.5	30	74.63	0.450	20.200
29	81.9	31	79.37	0.400	22.620
30	92.5	32	85.47	0.355	25.300
31	103	33	91.74	0 315	28.400
32	114	34	100.0	0.280	31.700
33	129	35	109.9	0 250	35.200
34	144	36	120.5	0 224	39.000
35	161	37	135.1	0.200	43 500
36	181	38	151.5	0.180	47.800
37	204	39	175.4	0.160	53.500
38	227	40	188.7	0.140	60.200
39	256	41	208.3	0.125	67.100
40	285	42	227.3	0.112	74.600
(41)	327	43	256.4	0.100	82.600
(42)	378	44	285.7		
(43)	421	45	322.6		
(44)	471	46	377.4		
(45)	523	47	444.4		
(46)	581	48	—		

Turns per cm based on grade one insulation

The accompanying table allows easy comparison of the different standards permitting a near equivalent to be selected if coil winding data (for example) specifies a gauge which is not readily available If 38 B&S were specified for a coil it can be seen that either 42 SWG or 0 1 mm metric has approximately the same diameter and could therefore be substituted

In the event that the precise gauge of an available wire is not known and no micrometer is available it can be determined quite easily with reasonable accuracy Wind some of the wire on a small mandrel such as a pencil and note the number of turns per unit length The gauge can now be determined from the tables

FRECUENCY -
WAVELENGTH CONVERSION

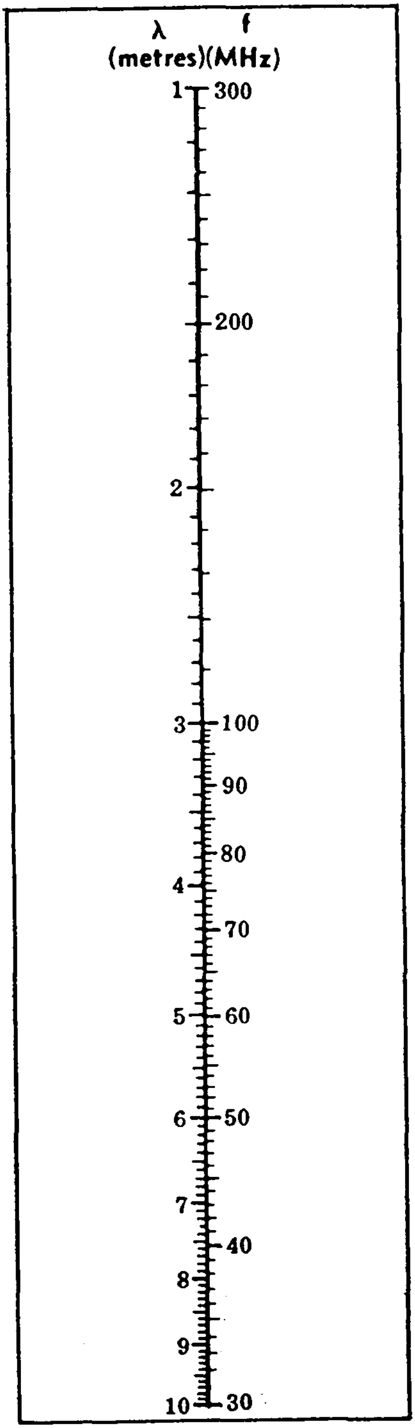
This chart gives the basic conversion from metres to MHz in the range 1 10m and 30-300MHz

FOR WAVELENGTHS

10m to 100m DIVIDE MHz by 10
100m to 1 000m DIVIDE MHz by 100
1 000m to 10km Answer is in kHz

FOR FREQUENCIES

30kHz to 300kHz MULTIPLY metres by 1 000
300kHz to 3MHz MULTIPLY metres by 100
3MHz to 30MHz MULTIPLY metres by 10
300 MHz to 3 000 MHz DIVIDE metres by 10



DECIBELS

Contrary to popular usage and belief the DECIBEL is not a unit of anything, as is the volt or ampere or ohm, but rather a ratio of voltages or currents or power levels in the electronics field. The human ear can detect sounds over a very wide range of power levels but its response is not linear. As the sound level increases the ear's apparent sensitivity decreases. A sound which is doubled in actual intensity does not seem to be twice as loud to the ear.

The ear in fact works on a logarithmic scale hence measurements on sound levels or on equipment that produces sound must be on the same logarithmic scale if they are to make sense.

THE DECIBEL CHART

The chart is the one most suitable for measurements on audio amplifiers and associated equipment, with one scale showing the ratio of power or voltage or current plotted against the decibel scale (dB). If specific examples need to be worked out the following formula can be used -

$$dB = 10 \log \frac{P1}{P2}$$

where P1 and P2 are the two power levels. If the output power is greater than the input power then the ratio, in dB, is positive, e.g. +6dB. If the output is less than the input the ratio is expressed as a negative value, e.g. -12dB. In either case P1 is the larger of the two values.

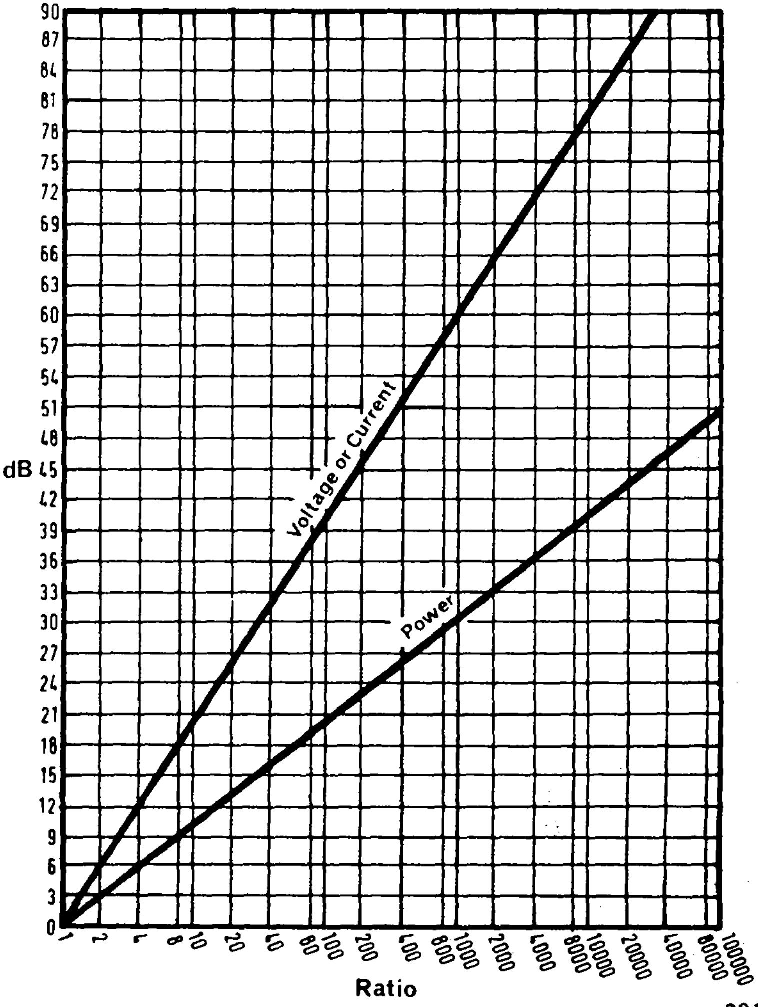
If the voltage or current is being considered the formula becomes:

$$dB = 20 \log \frac{V1}{V2}$$

The formula assumes that the input and output impedances are the same. If they are not then due allowance must be made in the formula.

The formula for taking into account differing input and output impedances is -

$$dB = 20 \log \frac{V1}{V2} + 10 \log \frac{Z1}{Z2}$$



BROADCASTING STATIONS

LIST ALPHABETICAL BY CALL-SIGN

LOCATION	CALL-SIGN	FREQ. (kHz)
NEW SOUTH WALES		
Armidale	2AD	1134
Armidale	2AN	720
Albury	2AY	1494
Bega	2BA	810
Bega	2BE	765
Moruya (Translator)	2BE	765
Broken Hill	2BH	567
Sydney	2BL	702
Bathurst	2BS	1503
Byrock	2BY	657
Canberra	2CA	1053
Canberra	2CC	1206
Sydney	2CH	1170
Canberra	2CN	1440
Albury	2CO	675
Cooma	2CP	1602
Orange	2CR	549
Campbelltown	2CT	1602
Canberra	2CY	846
Dubbo	2DU	1251
Sydney	2FA	801
Sydney	2FC	576
Sydney	2GB	873
Grafton	2GF	1206
Glen Innes	2GI	819
Goulburn	2GN	1368
Gosford	2GO	1323
Orange	2GZ	1089
Newcastle	2HD	1143
Sydney	2JJ	1539
Katoomba	2KA	783
Penrith (Translator)	2KA	1476
Kempsey	2KM	531
Newcastle	2KO	1413
Kempsey	2KP	684
Sydney	2KY	1017
Young	2LF	1359
Lithgow	2LG	1485
Lismore	2LM	900
Lithgow	2LT	1395
Mudgee	2MG	1449
Murwillumbah	2ML	720
Gunnedah	2MO	1080
Murwillumbah	2MW	972
Newcastle	2NA	1512
Broken Hill	2NB	999
Newcastle	2NC	1233
Muswellbrook	2NM	1458
Grafton	2NR	738
Tamworth	2NU	648
Bolwarra	2NX	1341
Inverell	2NZ	1188
Wollongong	2OO	1575
Parkes	2PK	1404
Deniliquin	2QN	1521
Taree	2RE	1557
Griffith	2RG	963
Sydney	2SM	1269
Nowra	2ST	999
Tamworth	2TM	1287
Taree	2TR	756
Sydney	2UE	954
Muswellbrook	2UH	1044
Sydney	2UW	1107
Moree	2VM	1530
Wilcannia	2WA	1584
Bourke	2WEB	576
Wagga	2WG	1152
Wollongong	2WL	1314
Wollongong	2WN	1431
Sydney	2WS	1224
Cooma	2XL	918
Canberra	2XX	1008

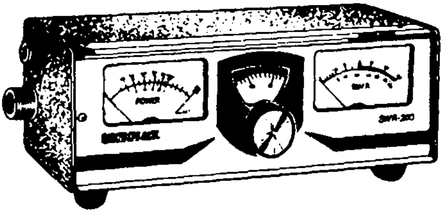
LOCATION	CALL-SIGN	FREQ. (kHz)
VICTORIA		
Melbourne	3AK	1503
Melbourne	3AR	621
Melbourne	3AW	1278
Ballarat	3BA	1314
Bendigo	3BO	945
Colac	3CS	1134
Melbourne	3CR	837
Maryborough	3CV	1071
Melbourne	3DB	1026
Melbourne	3EA	1116
Sale	3GI	828
Geelong	3GL	1350
Hamilton	3HA	981
Melbourne	3KZ	1179
Melbourne	3LO	774
Mildura	3MA	1467
Omeo	3MT	720
Wangaratta	3NE	1566
Swan Hill	**3SH**	**1332**
Shepparton	**3SR**	**1260**
Sale	**3TR**	**1242**
Warragul	**3UL**	**531**
Melbourne	3UZ	927
Warrnambool	3WL	1602
Horsham	3WV	594
Warrnambool	3YB	882
Melbourne	3XY	1422
Horsham	3WM	1089
Melbourne	3MP	1377
QUEENSLAND		
Oakley	4AK	1242
Atherton	4AM	558
Atherton	4AT	720
Ayr	4AY	936
Brisbane	4BC	1116
Brisbane	4BH	882
Brisbane	4BK	1296
Bundaberg	4BU	1332
Cairns	4CA	846
Gladstone	4CD	927
Biloela (Translator)	4CD	927
Gold Coast	4GG	1197
Charters Towers	4GC	1170
Gympie	4GM	1566
Toowoomba	4GR	864
Gympie	4GY	558
Hughenden	4HU	1485
Ipswich	4IP	1008
Julia Creek	4JK	567
Brisbane	4KO	693
Innisfail-Tully	4KZ	531
Longreach	4LG	1098
Mount Isa	4LM	1368
Maryborough	4MB	1161
Mount Isa	4MI	1080
Mackay	4MK	1026
Mossman	4MS	639
Nambour	4NA	828
Mackay	4QA	756
Maryborough	4QB	855
Emerald	4QD	1548
Brisbane	4QG	792
Longreach	4QL	540
Townsville	4QN	630
Eidsvold	4QO	855
Brisbane	4QR	612
Toowoomba	4QS	747
St George	4QW	711
Cairns	4QY	801
Rockhampton	4RK	837
Rockhampton	4RO	981
Kingaroy	4SB	1071
Southport	4SO	1593
Townsville	4TO	783
Charleville	4VL	918

LOCATION	CALL-SIGN	FREQ. (kHz)
Warwick	4WK	963
Weipa	4WP	1044
Roma	4ZR	1476
SOUTH AUSTRALIA		
Adelaide	5AA	1386
Adelaide	5AD	1323
Adelaide	5AN	891
Port Augusta	5AU	1242
Port Pirie	5CK	639
Adelaide	5CL	729
Adelaide	5DN	972
Adelaide	5KA	1197
Leigh Creek	5LC	1602
Port Lincoln	5LN	1485
Mount Gambier	5MG	1548
Murray Bridge	5MU	1458
Renmark	5MV	1593
Naracoorte	5PA	1161
Crystal Brook	5PI	1044
Renmark	5RM	801
Mount Gambier	5SE	1296
Streaky Bay	5SY	693
Adelaide	5UV	531
Woomera	5WM	1584
WESTERN AUSTRALIA		
Albany	6AL	630
Northam	6AM	864
Broome	6BE	675
Busselton	6BS	684
Bridgetown	6BY	900
Carnarvon	6CA	846
Collie	6CI	1134
Derby	6DB	873
Dalwallinu	6DL	531
Esperance	6ED	837
Geraldton	6GE	1008
Kalgoorlie	6GF	648
Geraldton	6GN	828
Perth	6IX	1080
Karratha	6KA	1260
Kalgoorlie	6KG	981
Kununurra	6KW	756
Perth	6KY	1206
Merredin	6MD	1098
Mount Newman	6MN	567
Narrogin	6NA	918
Northam	6NM	612
Perth	6NR	927
Port Hedland	6NW	1026
Port Hedland	6PH	603
Perth	6PM	990
Perth	6PR	882
Bunburry	6TZ	963
Albany	6VA	783
Wagin	6WA	558
Katanning	6WB	1071
Perth	6WF	720
Wyndham	6WH	1017
Perth	6WN	810
Exmouth	6XM	1188
TASMANIA		
Devonport	7AD	900
Burnie	7BU	558
Launceston	7EX	1008
Fingal	7FG	1161
Hobart	7HO	864
Hobart	7HT	1080
Launceston	7LA	1098
Launceston	7NT	711
Queenstown	7QN	630
Queenstown	7QT	837
Scottsdale	7SD	540
St Helens	7SH	1548
Hobart	7ZL	603
Hobart	7ZR	936

LOCATION	CALL-SIGN	FREQ. (kHz)
NORTHERN TERRITORY		
Alice Springs	8AL	1377
Darwin	8DN	1242
Darwin	8DR	657
Gove	8GO	990
Alice Springs	8HA	900
Katherine	8KN	675
Tennant Creek	8TC	684

ANTENNA MATCHING & SWR

With any transmitter it is important to match it to the antenna. Otherwise some of the power will not be effectively transmitted but instead reflected back into the transmitter. The SWR meter provides a means of measuring the "match".



MEASURING THE SWR

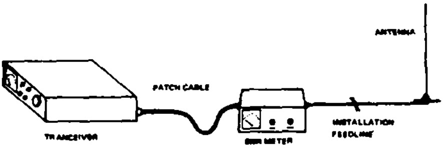
Follow the step-by-step procedure here and you will be surprised how easy it is!

(1) If you are using a single-meter instrument, switch to read *'forward'*.

(2) Turn the *'sensitivity'* control to minimum and then press the transmit button. Quickly adjust the sensitivity control to obtain maximum reading on the meter, or the forward meter on instruments with two meters.

(3) Now switch to *'reverse'* or *'reflected'* and the SWR will be indicated on the meter scale. Two meter instruments will show SWR on the 'reflected' meter.

(4) The table will tell you whether to worry or not!



It is almost impossible to have a perfectly matched antenna system and a standing wave ratio of 1:1 is virtually impossible. Here's what happens to your transmitter power for various standing wave ratios — plus comments.

SWR	PERCENTAGE POWER INTO ANTENNA	COMMENTS
1:1	100%	PERFECT
1.05:1	99.93%	EXCELLENT
1.1:1	99.78%	EXCELLENT
1.2:1	99%	V. GOOD
1.5:1	96%	GOOD
2:1	88%	IMPROVE IF POSSIBLE
2.5:1	82%	IMPROVE IF POSSIBLE
3:1	75%	BAD

LONG WAVE BEACONS

LOCATION	IDENT.	FREQ. (kHz)
Adelaide SA	AD	362
Aeropelican NSW	PLX	203
Albany WA	AL	240
Albury NSW	AY	236
Alice Springs NT	AS	224
Amberley Qld	AM	359
Andamooka SA	AMK	206
Archerfield Qld	AF	206
Ardrossan SA	ARS	398
Armidale NSW	ARM	401
Bairnsdale Vic	BNS	212
Balgo Hill WA	BGO	206
Ballidu WA	BIU	332
Barcaldine Qld	BAR	332
Bathurst NSW	BTH	383
Bendigo Vic	BDG	245
Birdsville Qld	BDV	209
Blackall Qld	BCK	203
Boorhaman Vic	BHN	203
Bordertown SA	BOR	251
Boulia Qld	BOU	212
Bourke NSW	BKE	389
Bowen Qld	BWN	292
Brisbane Qld	BN	302
Broken Hill NSW	BH	332
Bromelton Qld	BML	374
Broome WA	BR	320
Brunette Downs NT	BRU	248
Bundaberg Qld	BU	320
Cairns Qld	CS	364
Calga NSW	CAA	392
Camden NSW	CN	281
Camooweal Qld	CMW	254
Canberra ACT	CB	263
Carnarvon WA	CR	380
Casino NSW	CAS	332
Ceduna SA	CD	293
Chalkers NSW	CHK	206
Charleville Qld	CV	269
Christmas Island	XMS	341
Clackline WA	CKL	200
Clermont Qld	CMT	209
Cloncurry Qld	CCY	264
Cobar NSW	CBA	395
Cocos Islands	CC	305
Coen Qld	COE	404
Coffs Harbour NSW	CH	311
Condoblin NSW	CDO	401
Coober Pedy SA	CBP	212
Cooktown Qld	CKN	260
Coolangatta Qld	CG	278
Cooma NSW	CM	293
Coonabarabran NSW	CBB	200
Coonamble NSW	CNB	206
Cootamundra NSW	CTM	395
Corowa NSW	COR	380
Corryong Vic	CRG	386
Cowes Vic	CWS	275
Cowra NSW	CWR	299
Cunderdin WA	CUN	292
Cunnamulla Qld	CMU	218
Curtin Springs NT	CSP	200
Darwin NT	DN	344
Deniliquin NSW	DLQ	392
Derby WA	DB	332
Devonport Tas	DV	281
Dubbo NSW	DU	251
East Sale Vic	ES	350
Edinburgh SA	ED	311
Emerald Qld	EML	324
Esperance WA	ESO	328
Fitzroy Crossing WA	FTZ	407
Flinders Island Tas	FI	296
Forrest WA	FT	268
Gayndah Qld	GAY	284
Georgetown Qld	GTN	200
Geraldton WA	GN	360
Gibb River WA	GIB	392
Gladstone Qld	GL	236
Glen Elgin NSW	GGN	245
Glen Innes NSW	GLI	212
Goondiwindi Qld	GDI	398
Goulburn NSW	GLB	407
Gove NT	GV	380
Grafton NSW	GFN	389
Griffith NSW	GTH	305
Groote Eylandt NT	GTE	407
Gunnedah NSW	GDH	407
Halls Creek WA	HC	266
Hamilton Vic	HML	203
Hay NSW	HAY	209
Holbrook NSW	HBK	320
Hooker Creek NT	HOO	398
Horsham Vic	HSM	401
Hughenden Qld	HUG	340
Inverell NSW	IVL	260
Iron Range Qld	IR	392
Jervois NT	JVS	203
Julia Creek Qld	JLC	206
Kalgoorlie WA	KG	287
Karratha WA	KA	404
Katoomba NSW	KAT	353
Kilcoy Qld	KCY	392
King Island Tas	KI	332
Kingscote SA	KSC	215
Koolan Island WA	KLI	352
Kowanyama Qld	KOW	242
Kununurra WA	KU	227
Lake Albert SA	LRT	227
Lancelin WA	LCI	245
Launceston Tas	LT	242
Laverton Vic	LV	344
Laverton WA	LTN	407
Learmonth WA	LM	396
Leigh Creek SA	LC	341
Leonora WA	LEO	377
Lismore NSW	LIS	404
Longreach Qld	LR	353
Lord Howe Island	LH	272
McArthur River NT	MHU	200
Mackay Qld	MK	308
Mallacoota	MCO	338
Mangalore Vic	MN	254
Maningrida NT	MGD	401
Mansfield Vic	MFD	284
Marulan NSW	MRU	230
Maryborough Qld	MYB	248
Meekatharra WA	MR	351
Melbourne/Essendon Vic	EN	356
Merimbula NSW	MER	395
Mildura Vic	MI	272
Minnipa SA	MPA	200
Moomba SA	MMB	227
Moorabbin Vic	MB	398
Morawa WA	MRW	236
Moree NSW	MOR	392
Moruya	MRY	215
Mount Gambier SA	MG	266
Mount Hope SA	MTP	356
Mount Isa Qld	MA	236
Mount Livingstone Vic	LVG	227
Mount Magnet WA	MOG	324
Mount McQuoid NSW	MQD	404
Mount Sandon NSW	MSO	326
Mt William Vic	MWM	233
Mudgee NSW	MDG	398
Nambour Qld	NMB	380
Narembeen WA	NRB	227
Narrabri NSW	NBR	413
Narrandera NSW	NAR	329
Narromine NSW	NRM	215
Newman WA	NWN	233
Nhill Vic	NHL	326
Norfolk Island	NF	376
Normanton Qld	NM	312

LOCATION	IDENT.	FREQ. (kHz)
Norseman WA	NSM	384
Nowra NSW	NW	401
Nullagine WA	NUL	209
Nyngan NSW	NYN	404
Oakey	OK	254
Onslow WA	OL	312
Oodnadatta SA	OD	308
Orange NSW	OR	413
Paraburdoo WA	PBO	278
Parafield SA	PF	206
Parkes NSW	PKS	290
Perth/Gingin WA	GIG	372
Perth/Jandakot WA	JT	281
Perth WA	PH	400
Perth/Pearce WA	PE	340
Pingelly WA	PGL	233
Point Lookout NSW	PLO	266
Port Hedland WA	PD	260
Portland Vic	POD	209
Port Lincoln SA	PLC	389
Port Macquarie NSW	PMQ	395
Port Stanvac SA	PSV	236
Proserpine Qld	PPN	244
Quirindi NSW	QDI	386
Redland Bay Qld	RLB	218
Richmond Qld	RMD	215
Rockhampton Qld	RK	335
Roma Qld	ROM	377
Roper Bar NT	RRB	215
Rottnest Island WA	RTI	317
Rugby NSW	RUG	257
St George Qld	SGE	404
St Helens Tas	STH	392
Scone NSW	SCN	209
Singleton NSW	SGT	275
Southern Cross WA	SCR	221
Stonefield SA	SFL	257
Strahan Tas	SRN	257
Strathbogie Vic	SBG	413
Swan Hill Vic	SWH	407
Sydney NSW	SY	317
Sydney/Bankstown	BK	212
Sydney/Richmond	RI	347
Tailem Bend SA	TBD	242
Tamworth NSW	TW	341
Taree NSW	TRE	371
Taroom Qld	TAM	221
Temora NSW	TEM	212
Tennant Creek NT	TC	272
Thargomindah Qld	TGM	206
Thursday Island	HID	356
Tobooburra NSW	TIB	200
Timber Creek NT	TBR	212
Tindal NT	TN	388
Townsville Qld	TL	276
Victoria River Downs NT	VRD	377
Wagga Wagga NSW	WG	221
Walgett NSW	WLG	374
Warracknabeal Vic	WKB	212
Warrnambool Vic	WBL	395
Wave Hill NT	WAV	203
Wee Jasper NSW	WJS	374
Weipa Qld	WP	374
West Maitland NSW	WMD	224
West Wyalong NSW	WWL	389
Whyalla SA	WH	371
Williamsdale NSW	WLE	287
Williamtown NSW	WLM	365
Windorah Qld	WDH	407
Winton Qld	WTN	398
Wittenoom WA	WI	365
Wollongong NSW	WOL	242
Wonthaggi Vic	WON	383
Woomera SA	WR	248
Wyndham WA	WM	372
Wynyard Tas	WY	302
Yarrowee Vic	YWE	389
Yass NSW	YAS	335

CB RADIO CHANNELS

HF BAND

Channel No.	Frequency MHz	Use
1	26.965	
2	26.975	
3	26.985	
4	27.005	
5	27.015	
6	27.025	
7	27.035	
8	27.055	Road Channel
9	27.065	Emergency Channel (legally designated)
10	27.075	
11	27.085	AM Call Channel (legally designated)
	27.095	Phase out commences December 1984
12	27.105	
13	27.115	
14	27.125	
15	27.135	
16	27.155	SSB Call Channel (LSB) (legally designated)
17	27.165	
18	27.175	
19	27.185	
	27.195	Phase out commences December 1984
20	27.205	
21	27.215	
22	27.225	
23	27.255	
24	27.235	
25	27.245	
26	27.265	
27	27.275	
28	27.285	
29	27.295	
30	27.305	
31	27.315	
32	27.325	
33	27.335	
34	27.345	
35	27.355	
36	27.365	
37	27.375	
38	27.385	
39	27.395	
40	27.405	

UHF BAND

Channel No.	Frequency MHz	Channel No.	Frequency MHz
1	476.425	27	477.075
2	476.450	28	477.100
3	476.475	29	477.125
4	476.500	30	477.150
5	476.525	31	477.175
6	476.550	32	477.200
7	476.575	33	477.225
8	476.600	34	477.250
9	476.625	35	477.275
10	476.650	36	477.300
11	476.675	37	477.325
12	476.700	38	477.350
13	476.725	39	477.375
14	476.750	40	477.400
15	476.775		
16	476.800		
17	476.825		
18	476.850		
19	476.875		
20	476.900		
21	476.925		
22	476.950		
23	476.975		
24	477.000		
25	477.025		
26	477.050		

AUSTRALIAN VHF & UHF TELEVISION CHANNELS

VHF

Channel	Vision Carrier Frequency (MHz)	Frequency Limits (MHz)
0	46.25	45-52
1	57.25	56-63
2	64.25	63-70
3	86.25	85-92
4	95.25	94-101
5	102.25	101-108
5A	138.25	137-144
6	175.25	174-181
7	182.25	181-188
8	189.25	188-195
9	196.25	195-202
10	209.25	208-215
11	216.25	215-222

UHF

Channel	Vision Carrier Frequency (MHz)	Frequency Limits (MHz)
	Band IV	
28	527.25	526-534
29	535.25	534-542
30	543.25	542-550
31	551.25	550-558
32	559.25	558-566
33	567.25	566-574
34	575.25	574-582
	Band V	
39	615.25	614-622
40	623.25	622-630
41	631.25	630-638
42	639.25	638-646
43	647.25	646-654
44	655.25	654-662
45	663.25	662-670
46	671.25	670-678
47	679.25	678-686
48	687.25	686-694
49	695.25	694-702
50	703.25	702-710
51	711.25	710-718
52	719.25	718-726
53	727.25	726-734
54	735.25	734-742
55	743.25	742-750
56	751.25	750-758
57	759.25	758-766
58	767.25	766-774
59	775.25	774-782
60	783.25	782-790
61	791.25	790-798
62	799.25	798-806
63	807.25	806-814

27 MHz MARINE FREQUENCIES

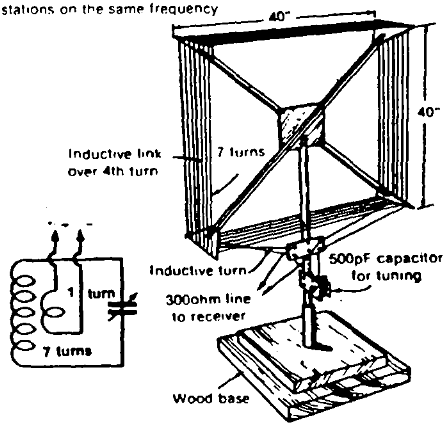
Channel	Frequency	Use
1	27.86 MHz	Secondary distress, urgency and safety messages. Also for handling weather and position reports.
2	27.88 MHz	Priority distress.
3	27.89 MHz	"Guard" band. (Previous use as general channel now to be discontinued.)
4	27.90 MHz	General. Ship-shore-ship (calling and working).
5	27.91 MHz	General. Ship-shore-ship (calling and working).
6	27.94 MHz	Club event. Ship-shore-ship or intership (calling and working).

LOOP ANTENNA REDUCES INTERFERENCE

Listeners wishing to receive broadcast band signals (525kHz to 1600kHz) in remote or difficult locations might well consider a loop aerial

This type of antenna is directional maximum pick-up is along the plane of the windings, minimum pick-up along a line at right angles to the windings

The loop is very simple to use. Tune in a station on the receiver, peak it with the loop tuning control and rotate the loop to optimum reception Frequently it is possible to null-out different stations on the same frequency



VHF AIRCRAFT CHANNELS

FREQ.	CHANNEL USAGE
118.1	Bankstown & other Secondary Towers
118.7	Canberra/Parafield Tower
118.9	Melbourne Departure
119.1	Club Frequency
119.4	Sydney Approach
120.5	Adel/Bris/Melb/Syd Tower
120.9	Auto Information Serv. (Secondary airports)
121.1	Area frequency
123.0	Sydney Departure
124.2	Adelaide Approach
124.4	Sydney Approach
124.7	Bris/Melb Approach
125.3	Sydney Departure
125.8	Area Frequency

AERODROME TERMINAL INFORMATION

A.M. MODE

BEACONS

ADELAIDE	117.3 MHz
SYDNEY	115.4 MHz
PERTH	113.7 MHz
CAIRNS	113.7 MHz
CANBERRA	113.5 MHz
ROCKHAMPTON	116.9 MHz
BRISBANE	113.9 MHz
MELBOURNE	113.9 MHz
ALICE SPRINGS	115.9 MHz
DARWIN	113.7 MHz
PORT HEADLAND	113.7 MHz

DEPARTMENT OF COMMUNICATIONS OPERATIONS BRANCH HEADQUARTERS

ASSISTANT SECRETARY, 570 Bourke Street, Melbourne, 3000
(Postal: G.P.O. Box 5412cc, Melbourne, 3001)
(Telephone: 03 609 1555) (Telex: AA 30148)

REGULATORY AND LICENSING SECTION

NEW SOUTH WALES

Superintendent, MLC Centre, Miller Street,
North Sydney, 2060 (Postal: P.O. Box 970
North Sydney, 2060)
(Telephone: 02 922 9111) (Telex: AA 24624)

District Radio Inspector, Australian
Government Offices, Molesworth Street,
Lismore, 2480
(Telephone: 066 21 6393) (Telex: Unavailable)

District Radio Inspector, 741 Hunter Street,
Newcastle West, 2302 (Postal: P.O. Box 2189,
Dangar, 2309)
(Telephone: 049 69 3399) (Telex: AA 28170)

District Radio Inspector, 28 Bridge Street,
Tamworth, 2340 (Postal: P.O. Box W75,
West Tamworth, 2340)
(Telephone: 067 65 7969) (Telex: Unavailable)

District Radio Inspector, 8 Station Place,
Wagga Wagga, 2650 (Postal: P.O. Box S266,
South Wagga Wagga, 2650)
(Telephone: 069 21 1855) (Telex: Unavailable)

District Radio Inspector, Australian
Government Offices, 86-88 Market Street,
Wollongong, 2500 (Postal: P.O. Box 1766,
Wollongong, 2500)
(Telephone: 042 28 9611) (Telex: AA 29112)

VICTORIA

Superintendent, 5th Floor,
14 Queens Road,
Melbourne, 3004
(Telephone: 03 26 6921) (Telex: AA 37503)

District Radio Inspector, 114 Armstrong Street South,
Ballarat, 3350
(Telephone: 053 31 1317) (Telex: AA 36904)

District Radio Inspector, 44a Nunn Street,
Benalla, 3672
(Telephone: 057 62 3288) (Telex: AA 56137)

District Radio Inspector, Hills Bazaar Bldg.,
Bath Lane,
Bendigo, 3550 (Postal: P.O. Box 458,
Bendigo, 3550)
(Telephone: 054 43 1110) (Telex: AA 37257)

District Radio Inspector, Australian
Government Centre, 79-81 Raymond Street,
Sale, 3850
(Telephone: 051 44 4555) (Telex: AA 55228)

WESTERN AUSTRALIA

Superintendent, 1st Floor, CAGA Centre,
256 Adelaide Terrace, Perth, 6000
(Postal: P.O. Box 6189, Perth,
Hay Street East, 6000)
(Telephone: 09 325 5877) (Telex: AA 93772)

TASMANIA

Superintendent, 1st Floor Continental Building,
162 Macquarie Street, Hobart, 7000
(Postal: P.O. Box 63, Sandy Bay, 7005)
(Telephone: 002 20 5011) (Telex: AA 58 265)

QUEENSLAND

Superintendent, 10th Floor Aviation House,
Cnr. Wickham and Ballow Streets,
Fortitude Valley, 4006 (Postal: P.O. Box 555,
Fortitude Valley, 4006)
(Telephone: 07 52 8822) (Telex AA 41528)

District Radio Inspector, Lonsdale Court,
49 Walker Street, Bundaberg, 4670
(Postal: P.O. Box 862, Bundaberg, 4670)
(Telephone: 071 72 2135) (Telex: AA 49688)

District Radio Inspector, State Government
Insurance Office, Cnr Shields Street and
The Esplanade, Cairns, 4870
(Postal: P.O. Box 1225, Cairns, 4870)
(Telephone: 070 51 4333) (Telex: AA 48055)

District Radio Inspector, 2A Sydney Street,
Mackay, 4740 (Postal: P.O. Box 337,
Mackay, 4740)
(Telephone: 079 51 1828) (Telex: AA 48527)

District Radio Inspector, Room 1
38 Marian Street, Mt Isa, 4825
(Postal: P.O. Box 1842, Mt Isa, 4825)
(Telephone: 077 43 6672) (Telex: AA 49934)

District Radio Inspector, 6 East Street,
Rockhampton, 4700 (Postal: P.O. Box 1401,
Rockhampton, 4700)
(Telephone: 079 27 6922) (Telex: AA 49170)

District Radio Inspector, 42-50 Sturt Street,
Townsville, 4810 (Postal: P.O. Box 522,
Townsville, 4810)
(Telephone: 077 71 5685) (Telex: AA 47149)

SOUTH AUSTRALIA

Superintendent, QBE Building, 108-116 King
William Street, Adelaide, 5000
(Postal: G.P.O. Box 2248, Adelaide, 5001)
(Telephone: 08 212 2153) (Telex: AA 88200)

District Radio Inspector, 40 James Street,
Mount Gambier, 5290 (Postal: P.O. Box 1545,
Mount Gambier, 5290)
(Telephone: 087 25 6170) (Telex: AA 80030)

District Radio Inspector, Custom's House,
Horwood Street, Whyalla, 5600
(Postal: P.O. Box 575, Whyalla, 5600)
(Telephone: 086 45 5999) (Telex: AA 80481)

AUSTRALIAN CAPITAL TERRITORY

District Radio Inspector, 7 Sargood Street,
O'Connor, 2601 (Postal: P.O. Box 40,
O'Connor, 2601)
(Telephone: 062 47 0677) (Telex: AA 62368)

NORTHERN TERRITORY

District Radio Inspector, CML Building,
61 Smith Street, Darwin, 5790
(Postal: P.O. Box 2540, Darwin, 5794)
(Telephone: 089 81 5566) (Telex: AA 85341)

REFERENCE BOOKS AND MAGAZINES

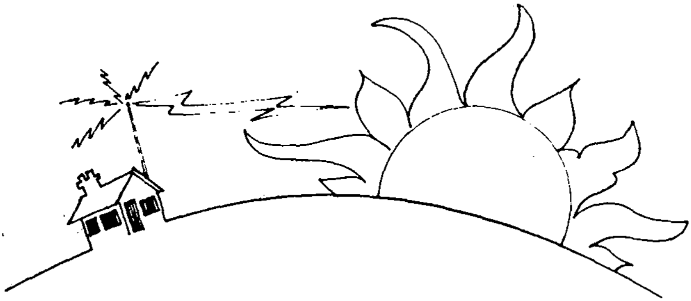
The following books and magazines are considered very helpful for anyone interested in getting together an amateur radio library. They are available from most electronic stores and some specialist bookshops.

BOOKS

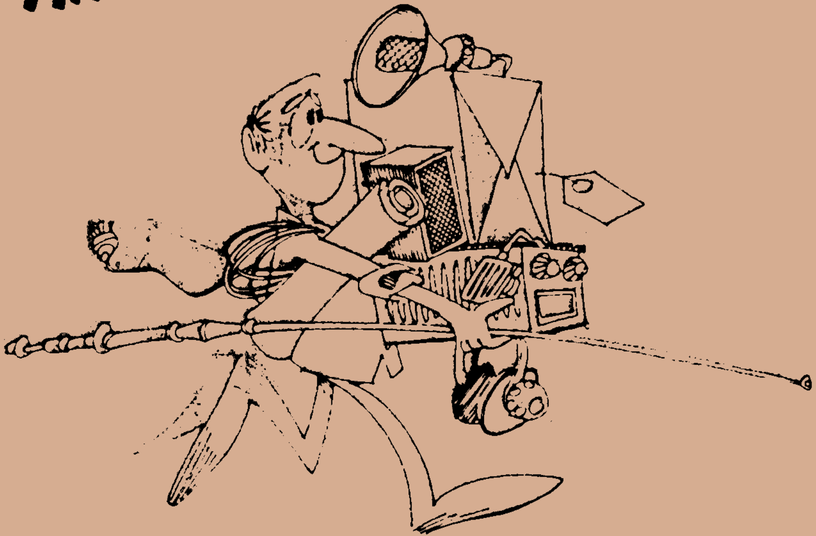
Radio Handbook
Radio Astronomy for Amateurs
Master Handbook of Ham Circuits
Amateur Radio Techniques
Guide to Amateur Radio
Teleprinter Handbook
VHF/UHF Manual
World Radio T.V. Handbook
Course in Radio Fundamentals
Antenna Handbook
Radio Amateur's Operating Guide
FM & Repeaters for Radio Amateurs
SSB for Radio Amateurs
Radio Amateurs VHF Manual
Radio Amateurs Handbook
Getting to know Oscar
Understanding Amateur Radio
Mini Log Book
Electronics Aust. Log Book
U.S. Radio Amateur Callbook
Foreign Radio Amateur Callbook.
Radio Amateur Prefix Map of the World
Great Circle Map
Novice Radio Guide — Ham Radio
80M DXing — Ham Radio
VHF Handbook
Low Cost Wire Antennas
Cubical Quad Antennas
Beam Antenna Handbook
Radio Amateur Antenna Handbook
Questions & Answers for the Novice Licence (Westlakes)

MAGAZINES

QST
Amateur Radio Action
Ham Radio
Electronics Australia
Break in
Electronics Today International



The ONLY Australian Amateur Radio Manual



- Covers every aspect of this unique and exciting hobby
- Written in language you can understand – you *don't* have to be an electronic wiz
- Explains how to get your licence
- Tells you what to buy
- What to build
- How to make your radio shack tick
- Detailed information on radio operating procedures and courtesies never before available together in print

ISBN 0 7255 1200 8